EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA

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IN

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BY

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DECLARATION

I declare that the thesis entitled "**EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA**" has been prepared by me under the guidance of **Dr. Jaspal Singh**, Professor & Head, Department of General Surgery, Dayanand Medical College and Hospital, Ludhiana. No part of this thesis has formed the basis for the award of any degree previously.

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The data collected in this thesis is genuine and the work has been carried out by the candidate himself.

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Dedicated

to

my family

&

Teachers

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DR. Raghav Khurana

ABBREVIATIONS

CST-	Component separation technique
ACS-	Anterior Component Separation
TAR-	Transversus Abdominis Release
USA-	United States of America
BMI-	Body Mass Index
COPD-	Chronic Obstructive Pulmonary Disease
CT-	Computed Tomography
PDS-	Polydiaoxanone suture

ABSTRACT

Introduction: Hernias of the anterior abdominal wall, or ventral hernias, represent defects in the parietal abdominal wall fascia and muscle through which intra-abdominal or pre-peritoneal contents can protrude. Ventral hernias may be congenital or acquired. Acquired hernias may develop via slow architectural deterioration of the muscular aponeurosis or they may develop from failed healing of an anterior abdominal wall incision after laparotomy.

Aim of Study: The objective of the present study is to evaluate the clinical outcome in patients with“Large Ventral Hernia”, repaired using “Transversus Abdominis Release Technique”

Materials & methods: The study was conducted on patients with “large ventral hernia”, admitted to the “Department of Surgery, DMC Hospital, Ludhiana” during the period “February 1, 2019 to April 30, 2020”. The clinical outcome in patients was measured in terms of: operation time; hematoma seroma; infection; recurrence of hernia; Any other complication The patients were followed up during the hospital stay as well as for a period of three months after discharge from the hospital. Descriptive statistical studies were used to evaluate the data collected.

Inclusion criteria: 1.The patients admitted with mid-line “large ventral hernia” with size of ≥10 cms at its maximum width. 2.Patients consenting to participate in the study.

Exclusion Criteria: Pregnancy, Peritonitis, Patients on immunosupressives, Patients already suffering from left heart failure, chronic liver disease, renal failure, pre existing entero-cutaneous fistula or skin defect.

Results: The study included 43 consenting patients maximum females patients mostly (75%) above the age of 50 years and 90% of them being overweight/obese who underwent repair of hernia by TAR technique with a mean duration of surgery being 254.7 minutes, of these patients 7 (16.3%), developed a seroma, 5 (11.6%) developed surgical site infection and 1 (2.3%) developed a recurrence. There was no deep infection or mesh infection or any significant pain abdomen post operatively. In none of the patients was the dreaded complication of abdominal compartment syndrome seen.

Conclusion: Transversus Abdominis Release Technique is a good technique for repair of large ventral hernias with good immediate post op outcomes and low recurrence rates.

Keywords: Ventral hernia, Transversus Abdominis Release.

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INTRODUCTION

Hernias of the anterior abdominal wall (or, ventral hernias) represent defects in the parietal abdominal wall (either fascia and/or muscle) through which intra-abdominal or pre-peritoneal contents can protrude. Ventral hernias may be congenital or acquired. Acquired ventral hernias may develop either via slow architectural deterioration of the muscular aponeurosis or from failed healing of an anterior abdominal wall incision after a laparotomy (Incisional hernia).

Incisional hernia remains a frequent complication of abdominal surgery with a reported incidence of 2-28%.[1-3] Further reports indicate that 26% of the patients undergoing laparotomy will go through additional surgery to repair an incisional hernia [4] because of various indications. The associated morbidity secondary to incarceration, strangulation & bowel obstruction is significant. Out of the patients undergoing incisional hernia repair, strangulation or incarceration is the indication for repair in 17% of such patients.[5] Less alarming symptoms are: recurrent intestinal obstruction, atrophic apical or intertrigous peripheral skin coverage of the hernial sac, chronic back pain or cosmetic complaints.

The cause of incisional hernia in any given case can be difficult to determine, but obesity, primary wound healing defects, multiple prior procedures, prior incisional hernias, and technical errors during repair may all be contributory. Hernias can occur at sites of defective healing within the approximated incision or at the suture puncture sites created during the closure, or both.

In a long standing hernia, a considerable amount of the abdominal contents will lose its “abdominal domain” due to abdominal wall weakness & lateral retraction of the muscles. This will lead to adverse effects on posture maintenance, respiration, micturition, defecation & biomechanical properties, which have a profound impact on patient's overall physical capacity & quality of life. When morbidity is added to the vast numbers & the tremendous costs associated with hernia

repair, it becomes clear that the efficacy of ventral hernia repair is of major importance.

Ventral hernia repair has been a difficult problem and typical reconstructive techniques have struggled to re establish abdominal domain and to create a lasting repair with low recurrence rates.

For the management of large incisional hernia, a lot of interest has been generated for the “Component Separation Technique”. In 1990 Ramirez et al[6] developed a technique- Anterior Component Separation for reconstructing abdominal wall defects without the use of prosthetic material. The technique is based on enlargement of abdominal wall surface by translation of muscular layers without severing the innervation & blood supply of the muscles. Later De Vries Reilingh et al in 1993[7] further developed this technique by adding separation of the posterior rectus sheath from the rectus abdominis muscle. Advancement was made by Geffen et al[8], who reported still better results by augmentation of the technique with implantation of mesh between rectus abdominis muscle & the posterior rectus sheath, leading to a drop in the recurrence rate to just 3.8%. It has been reported that with this technique abdominal wall defects upto 25-30 cm in the waistline can be bridged, and it has been found to be useful in both clean & contaminated situations. [6]

However, newer technique brings newer problems. Wound complications are frequent.[9] Hematoma & seroma formation including a high risk of wound infections and flap necrosis due to division of Para Umbilical Perforator Sparing vessels is very frequent whereas infections are reported to be there in upto nearly half of the patients. Recurrence was estimated to be 7-32%.[10]

Due to the drawbacks of Anterior CST and unacceptable complication rate a new surgical technique needed to be developed. Rives-Stoppa technique evolved as an effective repair with favorable outcomes and low morbidity. The posterior rectus sheath dissection provides release of the rectus muscle and a well vascularised “box” for mesh placement. But the procedure is not appropriate for large defects due to its frequent inability of anterior fascial closure which leads to large

surfaces of mesh under the skin predisposing to surgical site infection and mesh infection and further predisposing to recurrence of hernia.

Transversus abdominis release repair is a modification of the Rives-Stoppa technique is now being increasingly used to manage large ventral hernias and has shown promising results.

Transversus abdominis muscle release is a versatile technique of hernia repair that offers a reliable, durable solution to complex abdominal wall construction with low recurrence rates and lower morbidity and decreased rates of surgical site infection.[11] Transversus Abdominis Release can be utilized for repair of large ventral hernias (>10cm) which pose a challenge to the surgeon.

Posterior component separation by transversus abdominis release seems to be the ideal approach for complex ventral hernias with good immediate outcomes.[12]

In view of the challenging management of large ventral hernias and promising early results shown by the Transversus abdominis release technique in their management, this study was planned.

AIMS AND OBJECTIVES

To evaluate the clinical outcome in patients with "Large Ventral Hernia" repaired using "Transversus Abdominis Release Technique"

REVIEW OF LITERATURE

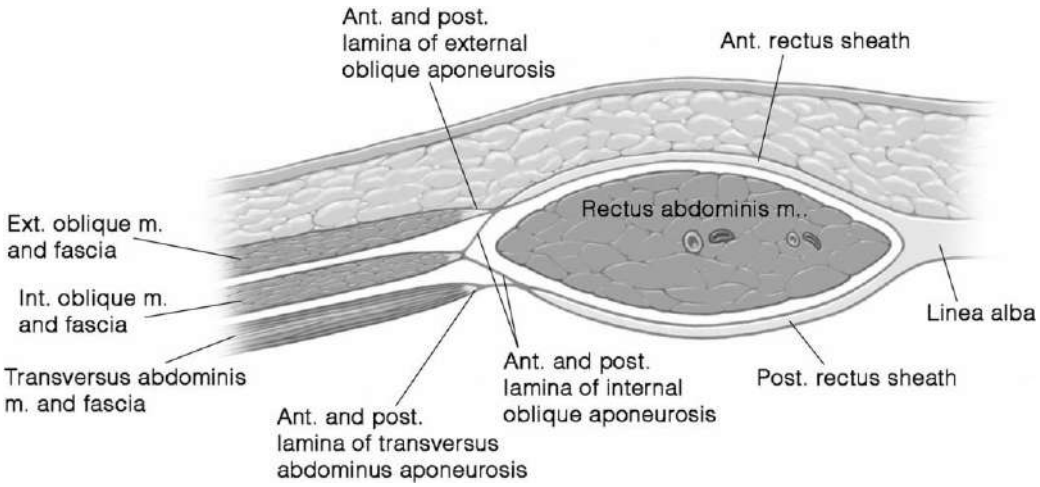
Abdominal wall hernia formation remains the most common complication following laparotomy, occurring in upto 28% of the patients undergoing abdominal surgery.[13] Hernia repair has undergone vast evolution in the last 5 decades. Surgeons have embarked on an incessant search for the “optimal approach” to repair ventral hernias, driven perhaps by their patients’ frustration as well as their own when faced with a failed repair after what initially looked like the “perfect surgery.” These efforts have led to remarkable accomplishments in hernia surgery.

Abdominal wall anatomy as simple it may seem haunts the surgeon when it comes to occurrence of hernia and when the procedure for repair is to be decided. The rectus abdominis muscle on each side is enclosed anteriorly and posteriorly by the rectus sheath (anterior and posterior rectus fasciae). The anterior rectus fascia extends the entire length of the muscle and fuses with the tendinous insertion of the muscle cranially and caudally. In contrast, the posterior rectus sheath is complete in the upper two-thirds of the muscle, but posterior to the caudal one-third of the rectus muscle, the posterior rectus fascia gradually fades away at the semi-circular or arcuate line (line of Douglas)about mid-way between the umbilicus and the pubis. Caudal to this line, the rectus abdominis muscle is enclosed posteriorly only by the transversalis fascia, any preperitoneal connective tissue, and the peritoneum. The rectus sheath is formed from decussating fibers from all three lateral abdominal muscles—the external oblique, internaloblique, and transversus abdominis each of which form abilaminar aponeurosis at their medial borders. The anterior rectus sheath is composed of both leaves (or laminas) of the external oblique aponeurosis and the anterior lamina of the

Internal oblique aponeurosis. The posterior rectus sheath is composed of both laminas of the transversus abdominis aponeurosis and the posterior lamina of the internal oblique aponeurosis. The lower thoracic and upper lumbar nerves perforate the lateral-most aspect of the

posterior rectus sheath; actually to be specific, these nerves perforate the posterior lamina of the internal oblique aponeurosis to enter the rectus muscles laterally and innervate the rectus muscles. The anterior and posterior rectus sheath then decussate with the contralateral counterparts at the midline—the linea alba.[14] Surgeons have utilized this detailed knowledge of anatomy to find the best possible procedure for repair of ventral hernia without compromising the vascular supply and biomechamincs of the abdominal wall, rather to strengthen it to prevent hernia recurrence.

Fig 1: Anatomy of anterior abdominal wall


Ant. and post. lamina of external oblique aponeurosis
Ant. rectus sheath
Rectus abdominis m..
Ext. oblique m. and fascia
Int. oblique m. and fascia
Transversus abdominis m. and fascia
Linea alba
Ant. and post. lamina of internal oblique aponeurosis
Post. rectus sheath
Ant. and post. lamina of transversus abdominus aponeurosis

Initial hernia repairs defined were that by primary fascial closure but with the unacceptable rates of hernia recurrence seen with primary fascial repairs, the first revolution in hernia surgery came with the concept of the tension-free fascial closure with mesh. Soon enough, mesh repair became the gold standard for elective ventral hernia repair. The second revolution came later when, still uncomfortable with persisting high rates of recurrence despite the use of mesh, Dr's Rene Stoppa, Jean Rives, and George Wantz explored the retromuscular and preperitoneal planes of the abdominal wall, contributing to significant refinements in surgical techniques, initially described for inguinal region [15] and further modified to include midline hernias, mesh now could be placed in a space that was well-vascularized and entirely excluded from the bowel. This technique, although unknown at that time, was the first true myofascial release, because it involved

releasing the rectus muscle from its fascial compartment and provided 5 cm of medial advancement on each side of the abdomen.[16]

Although the Rives-Stoppa retromuscular repair has gained popularity and became the global “standard approach” for incisional hernia repairs, it still was not sufficient to adequately fix larger and more complex defects. Larger hernias posed a difficult challenge to the surgeon who aimed at achieving a primary fascial approximation in the absence of undue tension. Primary fascial closure of the defect has now been established as essential and when tackling with large ventral hernias this sometimes becomes difficult. Dr Oscar Ramirez was responsible for starting the third revolution in hernia surgery by describing the anatomic components separation of the abdominal wall[17], which became what is now known as “abdominal wall reconstruction.” He described the anterior components separation that involved the release of the external oblique muscle and fascia to achieve medial advancement. The approach of anterior component separation (ACS) as described by Ramirez, despite its wide fascial advancement and improved functional outcomes is encumbered by a significant wound morbidity at rates as high as 50% even in the presence of peri-umbilical perforators sparing.[18,19] Minimally invasive surgery modifications reduced surgical site events but could not improve the recurrence rate which is still up to 30%.[20] Subsequent modification of this technique arose, each with its own set of disadvantages. This technique allowed for significant myofascial advancement and wide mesh overlap in the sublay position, while preserving blood supply to subcutaneous tissue and skin. As the number of large and complex abdominal wall defects is increasing it is obvious that the procedure of Anterior Component Separation is not adequate for such pathology. Some modifications of the technique were reported but the limited advancement of the rectus abdominis muscle make them inappropriate.[21,22]

In 2012 Novitsky et al reported a novel approach to posterior component separation by Transversus Abdominis muscle Release.[6] This is a lateral extension of Rives – Stoppa repair with the creation of

a wide space between the transversus abdominis muscle and fascia transversalis- peritoneum complex. Transversus abdominis release is gaining popularity due to initially promising results. The technique is a modification of the classical Rives-Stoppa technique, the transversus abdominis muscle is released medial to the linea semilunaris to expose a broad plane that extends from the central tendon of the diaphragm superiorly, to the space of Retzius inferiorly, and laterally to the retroperitoneum. This preserves the neurovascular bundles innervating the medial abdominal wall. Mesh is placed in a sublay fashion above the posterior layer. In an overwhelming majority of patients, the linea alba is reconstructed, creating a functional abdominal wall, the most important aspect of hernia repair surgery, with wide mesh reinforcement. The technique is reliable and durable, with a 5 percent recurrence rate at 2 years.[22] Although wound complications occur with a frequency similar to that of other techniques, they tend to be less severe, rarely requiring operative debridement.

There are 3 main advantages to this approach as described by Novitsky et al in 2012.[23] First, transversus abdominis muscle release results in significant medial mobilization of the posterior rectus sheath. Second, it allows for extensive lateral dissection in a potentially unlimited space between the transversus abdominis muscle and the underlying transversalis fascia/peritoneum. Finally, it avoids disruption of the nerves and blood supply to the rectus abdominis and anterolateral abdominal wall skin. Overall, the TAR technique allows not only for a relatively tension-free repair with a large mesh but also myofascial reconstruction dorsal and ventral to the mesh, potentially restoring the native biomechanics of the abdominal wall.

The key component to the TAR technique is the release of the transversus abdominis muscle itself. The main function of this muscle, in conjunction with the internal oblique, is to act as a “corset” by creating hoop tension around the abdomen. The synergistic action of the transversus and the posterior fibers of the internal oblique produce this tension throughout the thoracolumbar fascia.[24-29] As the transversus is activated, it draws the abdominal wall inward, and

therefore increases the intra-abdominal pressure.[24-29] As a result, it was postulated that by dividing the transversus abdominis it was possible to release the circumferential tension, thus providing for an increase of the abdominal cavity and significant medial advancement of the posterior rectus fascia. In addition, TAR also affords medial advancement of the anterior rectus sheath/rectus muscles allowing us also to reapproximate the anterior rectus sheath. Although the exact degree of fascial advancement is difficult to assess, initial experiences shows that the TAR affords 8 to 12 cm of advancement per side in most patients. In this fashion it is possible to restore the anatomy of the anterior abdominal wall and provide a dual layer of fascial closure to facilitate repair and minimize mesh infections.

While there are no randomized control trial data regarding transversus abdominis muscle release technique, Novitsky et al, from their single specialist hernia unit in the USA, have published their outcomes of 347 patients at mean follow-up of at least 1 year, showing a recurrence rate of 3.7% and a surgical site infection rate of 9.1%[6], which as compared to Anterior component separation technique where with Reilingh TSet al[24] reporting a rate of 12-67%, including hematoma, seroma, skin necrosis & infection and Geffen et al[25] reporting a rate of 58%. In addition, anterior component separation technique struggles to address hernias with certain complicating factors. Non midline, sub xiphoid, suprapubic, and parastomal hernias and hernias with loss of domain are difficult to correct with this technique.[13] Posterior component separation with transversus abdominis release a recently defined technique by Novitsky et al in 2012 has been found useful in addressing particularly difficult cases in abdominal wall reconstruction.[26-31]

Today, transversus abdominis release has become a procedure of choice for a vast majority of large and complex ventral hernias and those with loss of abdominal domain.[27]

MATERIAL AND METHODS

SOURCE OF DATA:

The study was conducted on patients with “large incisional hernia”, admitted to the “Department of Surgery, DMC Hospital, Ludhiana” during the period “February 1, 2019 to April 30, 2020”.

METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

1. The patients admitted with mid-line “large ventral hernia” with size of ≥10 cms. at its maximum width.
2. Patients consenting to participate in the study.

EXCLUSION CRITERIA

1. Pregnancy.
2. Peritonitis.
3. Patients on immunosuppressives or suffering from cancer.
4. Patients already suffering from left heart failure due to any cause, chronic liver disease or renal failure.
5. Pre-existing entero-cutaneous fistula, ostomy, skin defect.
6. Patients already suffering from respiratory compromise, i.e. COPD.

METHODS

Patient related factors recorded were age, gender, abdominal surgery history, BMI, COPD, diabetes, smoking status, constipation, prostatism, site & size of abdominal wall defect & the symptom/s urging the current hernia repair. Any evidence of skin defect, fistulation or ostomy etc. were also recorded. Apart from the routine investigations, CT Scan abdomen, i) to measure the hernia defect; ii) to see all other hernias e.g. ostomy site hernia iii) to know about condition of abdominal muscles; iv) to measure loss of domain, was done for every patient along with other investigation like ultrasonography of abdomen, echocardiography, spirometry which were optional according to the requirements of the situation. All efforts were made to eliminate any local skin infection etc. pre-operatively.

The procedure, was be started by generous midline laparotomy incision and removal of all previously implanted synthetic material

(mesh). Complete adhesiolysis, at least of all attachments to the abdominal wall and dense interbowel adhesions, were performed to create a maximally mobile abdominal wall with no fibrotic restraints. Next step was the creation of the retrorectus space which was initiated at the level of the umbilicus. An incision was made on the posterior sheath 0.5 cm away from its medial edge. Rectus Abdominis was identified to prevent entering the pre-peritoneal plane. The incision was extended cranially and caudally on the entire length of the Rectus sheath and the retro-rectus space was developed by blunt or sharp dissection. Laterally the dissection was extended to the semilunar line. Care was taken to prevent damages of the epigastric vessels and of the neurovascular branches of the Rectus Abdominis muscle which perforate the posterior sheath just medial to Spiegel line. The retro-rectus plane was continued by cranial dissection to the retro-xiphoyd plane and caudally in the pre-peritoneal space of Retzius with identification of both Cooper's ligaments and pubic symphisis.

Next was the incision of the posterior rectus sheath in the upper third of the abdomen, 0.5 cm medial to the perforating neurovascular bundles of the thoraco – abdominal nerves the posterior rectus fascia was sharply incised to expose the underlying transversus abdominis muscle.

Once the muscle is exposed the fibers are then divided along its entire medial edge. The separation from the pre- peritoneal plane was done easily with an "L" curved dissector. (In the upper third the muscle is well developed and easy to identify; its volume regress in the distal 2 thirds where there is no muscle but only tendinous component.)

Next was the creation of the fascia transversalis plane between the edges of the transected transversus abdominis muscle and a new pre-peritoneal plane was created between the transversus abdominis muscle on one side and fascia transversalis and peritoneum on the other side. Two Allis clamps on the lateral edge of the transversus abdominis muscle were elevated together with the muscle by the assistant surgeon. Left hand of the surgeon pushed inferiorly, the medial edge of the transversus abdominis muscle so a dihedral angle

was created between the muscle and the peritoneum. With a mounted swab the undersurface of the lateral border of the transversus abdominis muscle was freed from the fascia transversalis and peritoneum. All peritoneal tears were carefully closed with an absorbable suture (3-0 Vicryl) to avoid protrusions of the small bowel under the mesh. Laterally the dissection was extended as far as the psoas muscle; it's lateral border was used as a landmark.

The cranial extent of the dissection depended on the extent of the defect; in upper hernias the space was advanced cranially through the costal margins to view the diaphragm. Inferiorly the pre-peritoneal plane is contiguous with the space of Retzius in the median line and with the space of Bogros on its lateral part. The medial attachments of line of Douglas were transected to allow access to the pre-peritoneal plane. The cord (in male patients) was parietelised and the round ligament (in female patients was resected to extend the dissection in space of Bogros and both myopectineal triangles.

After the release was completed on both sides, the posterior sheath was then reapproximated on midline with running, delayed absorbable suture (PDS 2-0) recreating the visceral sac.

This was followed by mesh placement, 30 x 30 cm soft prolene mesh was used in all patients, which was placed in sublay position in a diamond configuration, occupying all the retromuscular, preperitoneal, and retroperitoneal spaces. The inferior aspect of the mesh was secured to both of Cooper's ligaments and the pubis with interrupted sutures of Prolene 2-0. Superiorly, the mesh was secured with 2 interrupted sutures around the xiphoid and on each costal margin. The lateral aspects were not sutured. Then two large suctions drains were placed over the mesh and anterior fascial closure was done using running Prolene no. 1 suture, followed by approximation of skin and subcutaneous tissue, which was sutured using Ethilon 2-0 or skin staplers.

Post-operatively strict bed rest was advised for 3 days. Pulmonary physiotherapy is started. Drains were allowed to stay in situ until the 5th post-operative day or till the drain output dropped to <30ml per day.

Additionally, when patients were mobilized an abdominal binder was applied to further diminish the risk for seroma formation. Oral sips of water were started on post operative day 1.

DURATION OF STUDY

The study was conducted on patients with “Large ventral Hernia”, admitted to “DMC Hospital, Ludhiana” during the period “January 2019 to April 2020”.

OUTCOME

The clinical outcome in patients was measured in terms of:

a) Operation time;

b) Hematoma;

d) Seroma;

e) Infection;

f) Hospital stay time;

h) Occurrence of pain abdomen (by visual analogue scale);

i) Recurrence of hernia;

j) Any other complication

The patients were followed up during the hospital stay as well as for a period of three months after discharge from the hospital.

STATISTICAL ANALYSIS:

Data was described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

OBSERVATIONS AND RESULTS

This study was conducted on 43 consenting patients with mid-line "large Ventral Hernia" with size of ≥10cms at its minimum width. They were treated with "TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE". They were followed up during the hospital stay as well as for a period of three months after discharge from the hospital. Following observations were made:

AGE

The age of the patients ranged from 40 to 72 years of age. Mean age was 58.4 years. Majority of the patients were above 51 years of age (69.8%) and nearly 2/5th of the patients were above 61 years of age.

Table1: Age Distribution

Age group	No. of cases	Percentage
18-40	1	2.3%
41-50	10	23.3%
51-60	13	30.2%
61-70	16	37.2%
Total	43	100%

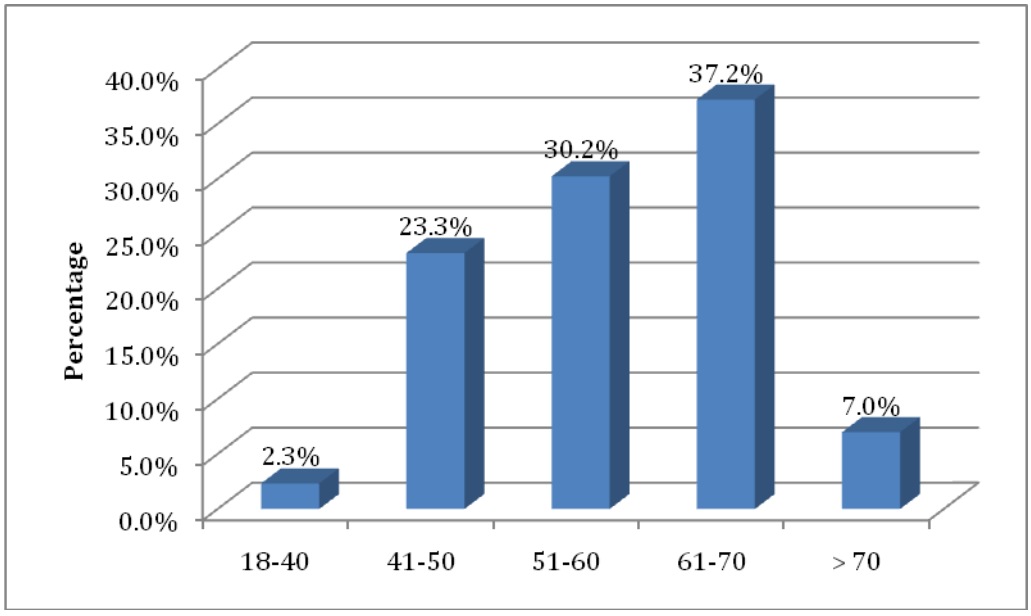


Fig 2: Age Distribution

GENDER

In this study, there was predominance of females (65.1%) as compared to males (34.9%).

Table 2: Gender Distribution

Gender (M/F)	No. of cases	Percentage
F	28	65.1%
M	15	34.9%
Total	43	100.0%

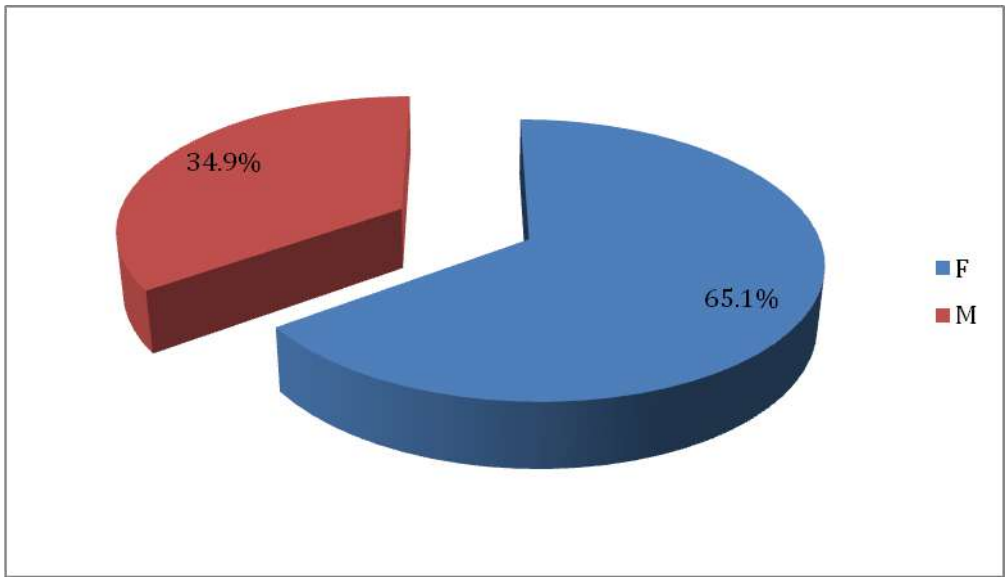


Fig 3: Gender Distribution

BMI OF PATIENTS

The BMI of the patients in the study ranged from 22 to 37 kg/m^{2}of body surface area with a mean of 29.3 kg/m^2 of body surface area. Only 4(9.3%) patients had a BMI less than 25 whereas more than half the patients were obese with BMI >30 or morbidly obese with BMI>35.

Table 3: BMI distribution

BMI	No. of cases	Percentage
<25	4	9.3%
25 to <30	16	37.2%
30 to <35	21	48.8%
35 and above	2	4.7%
Total	43	100%

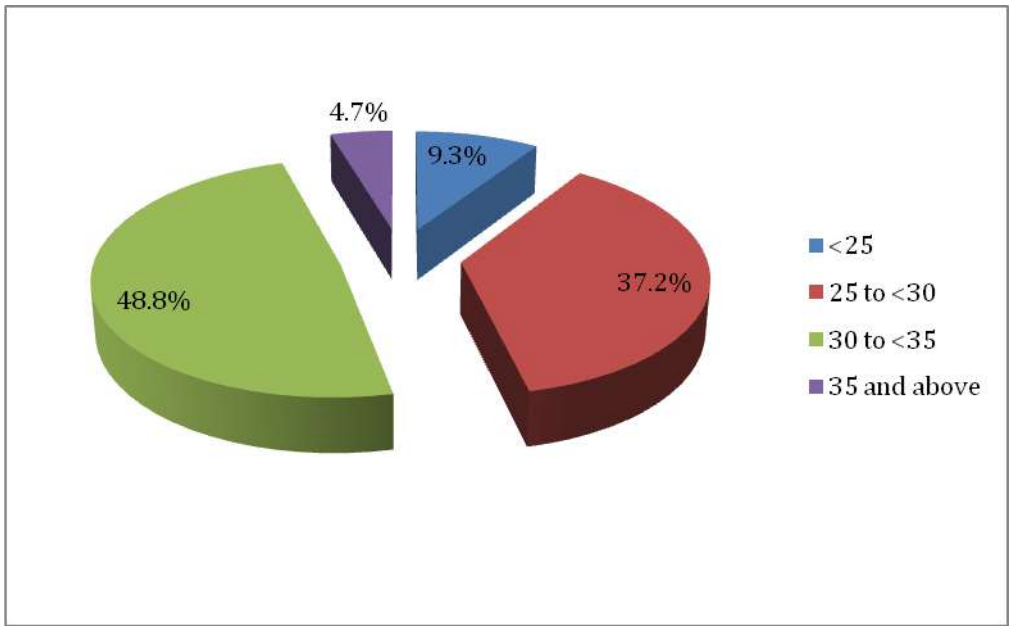


Fig 4: BMI distribution

ASSOCIATED COMORBID CONDITIONS

34.8% (15 patients) complained of constipation, 32.6%(14 patients) of the patients had Diabetes mellitus as a coexisting disease and 11.6%(5 male patients) of the total patients had symptoms suggestive of prostatism. 4.7% (2 patients) gave a history of smoking and 9.3%(4 patients) had history asthma but there was no evidence of COPD in the patients having history of smoking or asthma as confirmed by spirometry.

Table 4: Co morbid Conditions

Associated condition	No. of cases	Percentage
Constipation	15	34.8%
DM	14	32.6%
Smoking	2	4.7%
Asthma	4	9.3%
Prostatism	5	11.6%

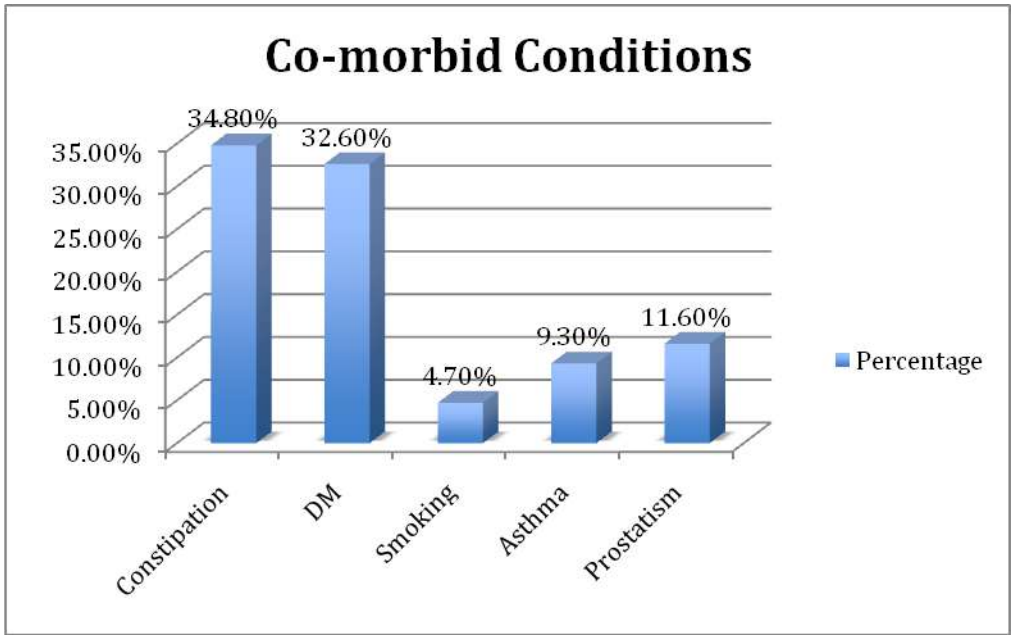


Fig 5: Co morbid Conditions

PREVIOUS ABDOMINAL SURGERY

Exploratory Laparotomy for perforation peritonitis was the single largest reason for the occurrence of hernia in our study 17 of the total 43 patients (37.6%). 11(25.3%) of the total patients had history of obstetric or gynaecological surgery and 8(18.6%) had history of hernia repair surgery in the past.

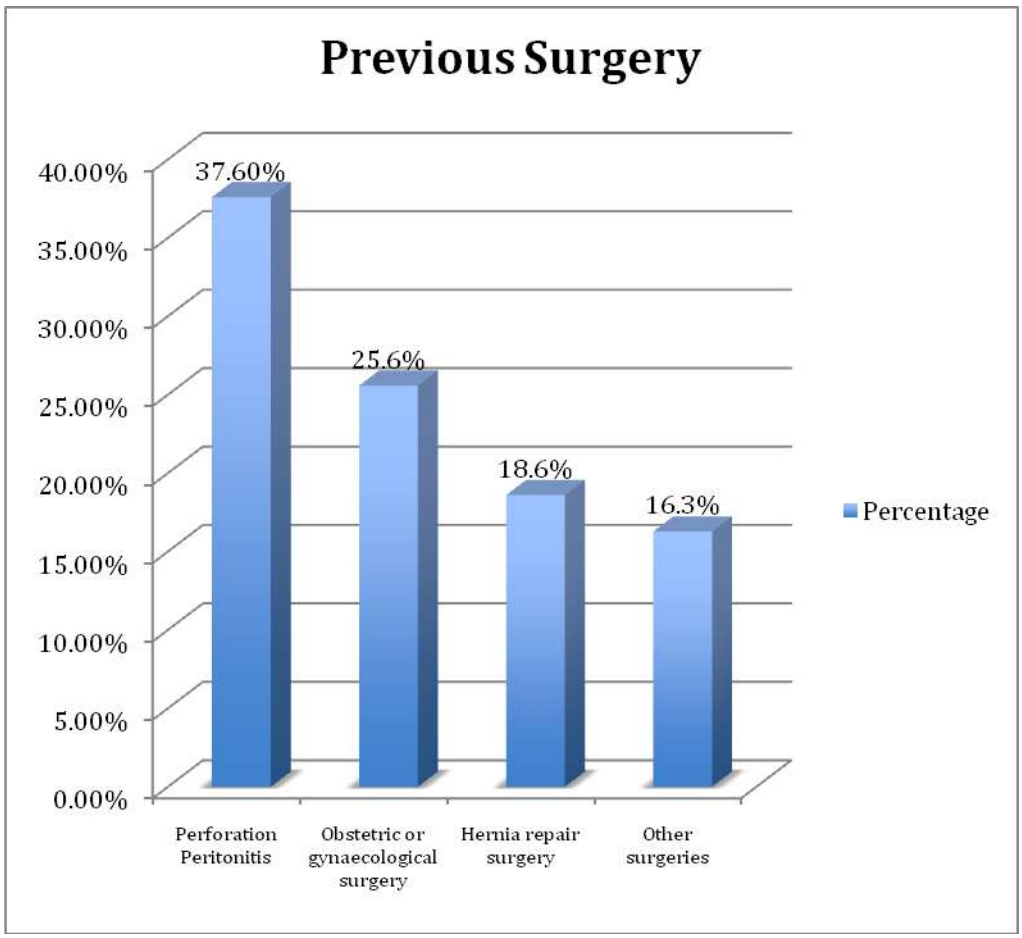


Fig 6: Previous surgery

SYMPTOM/S AT THE TIME OF PRESENTATION

It was observed that patients presented for surgery either when the hernia became apparent and was causing cosmetic problems-23 patients (53.4%), discomfort in daily life- 31 (72.09%) and chronic back pain- 11 (25.5%). Some patients had more than one cause as well.

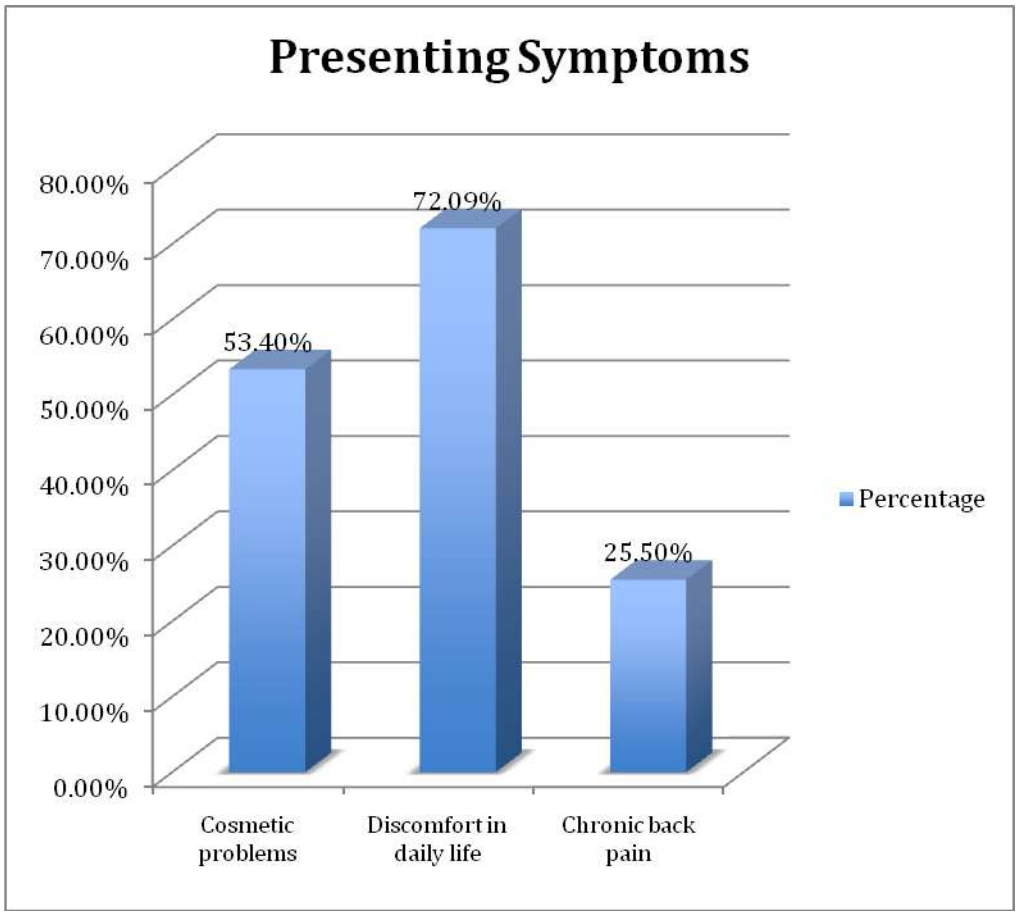


Fig 7: Presenting Symptoms

OPERATION TIME

The operation time had a wide variation ranging from 3 hour to 5 and half hours with a mean time of 254.7minutes. However, 55% of cases were operated upon within 270mins.

Table 5: Duration of surgery

Duration of surgery (min)	No. of cases	Percentage
Less than 180	0	0.0%
180 to <240	15	34.9%
240 to <300	18	41.9%
300 to <360	10	23.3%
Total	43	100.0%

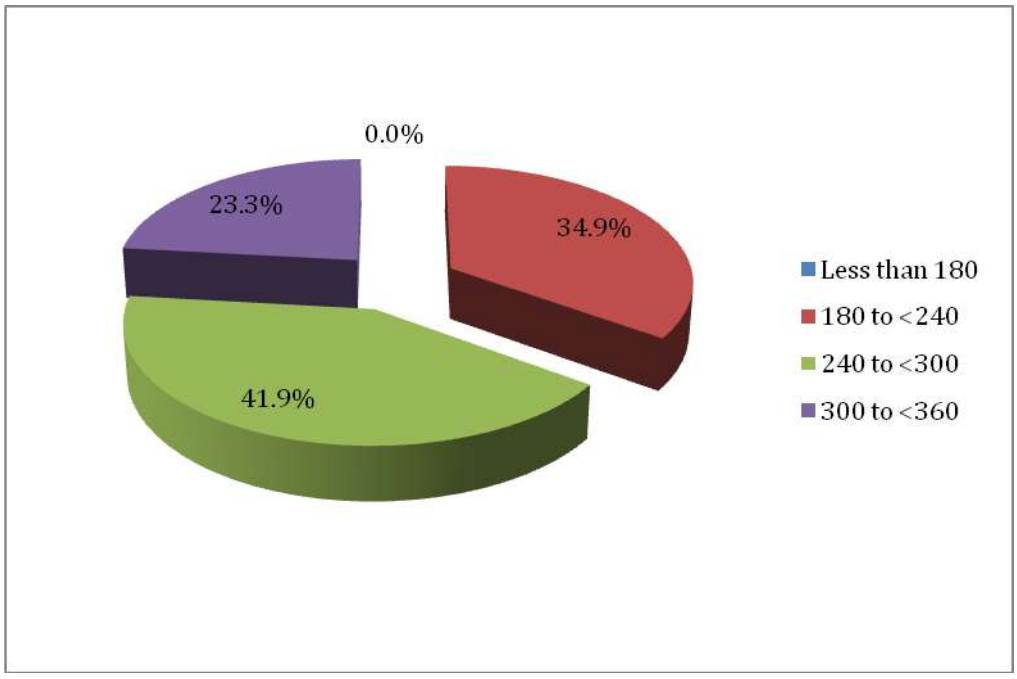


Fig 8: Duration of surgery

TIME TAKEN FOR REMOVAL OF DRAINS

Nearly 4/5ths of the drains were out by the end of the 1st week of surgery, and all drains were removed by day 10.

Table 6: Drain removal time

Time taken to remove drains (Days)	No. of patients	%age of patients
On day 5	18	41.9%
Upto 7 days	16	37.2%
Upto 10 days	9	20.9%

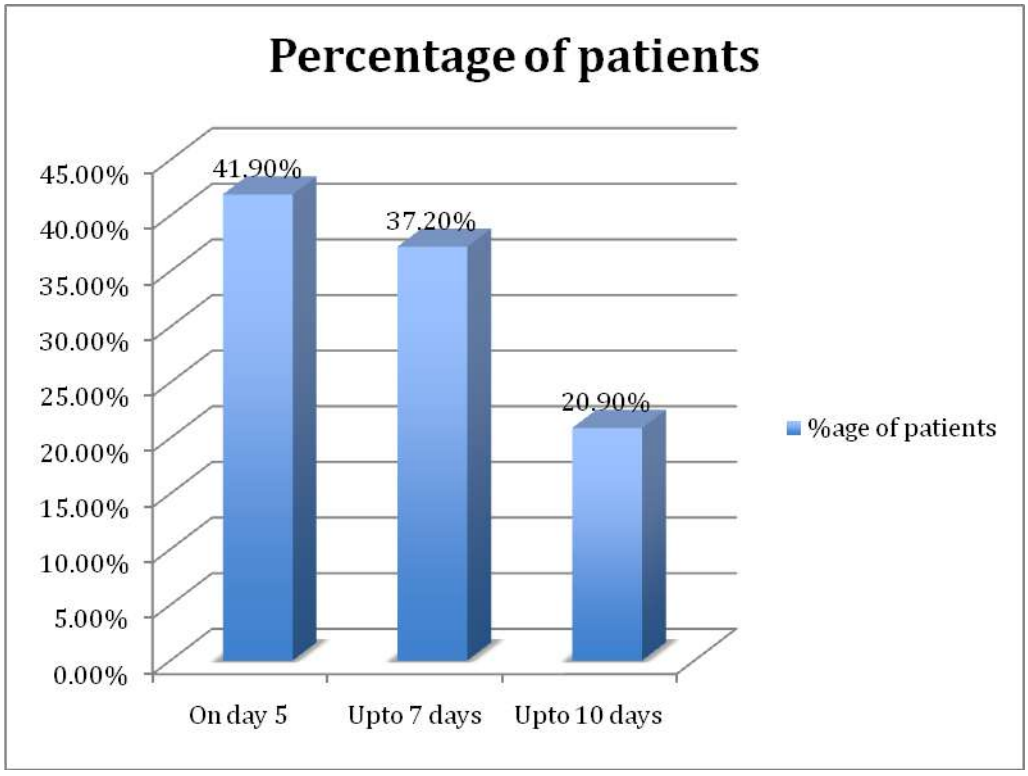


Fig 9: Drain removal time

HOSPITAL STAY TIME

Patients in this study were hospitalized for 6 to 13 days with a mean period of 9.7 days. All the patients were discharged within 2 weeks of admission.

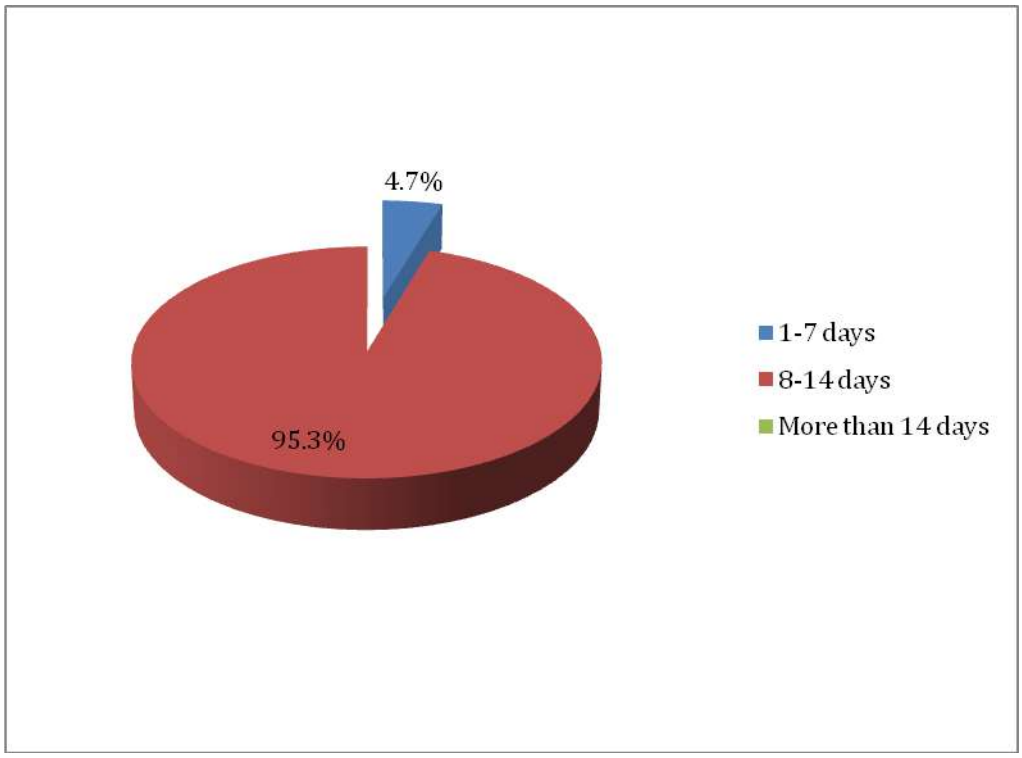


Fig 10: Hospital stay time

EARLY POST-OP COMPLICATIONS

Seroma and surgical site infection were the early post op complication noted in the patients. Seroma occurred in 7(16.3%) patients and surgical site superficial infection occurred in 5(11.6%) of the patients. They had no relation with gender, co-morbid conditions, size or site of the hernia. Both complications were managed conservatively in all the patients. Dreaded complication of abdominal compartment syndrome was not encountered in the study.

DELAYED POST-OP COMPLICATIONS

OCCURRENCE OF PAIN ABDOMEN

None of the patients in the study complained of any pain apart from the pain at the local wound site. After discharge and on follow up, none of the patients developed any significant pain.

RECURRENCE OF HERNIA

In the present study only one of the patients was found to have recurrence of hernia during the follow up period as confirmed clinically and on ultrasound imaging of the abdomen. There was no correlation with diabetes, smoking/asthma, prostatism or constipation.

INTERFERENCE WITH DAILY ACTIVITIES

During follow up of three months after discharge, 5 patients reported mild interference in daily activities like defecation, weight bearing or tying shoe-laces etc.

DISCUSSION

Age and sex distribution

In our study the mean age of the patients was 58.4 years (range being 40-72) years, with 16 (40%) out of 43 patients being above the age of 61 years. In the study of Appleton et al [32] the mean age of the patients was 62.5 years.

In our study gender distribution revealed more females 28(65.1%). However, variable reports of gender distribution are there in the literature.

In the series of Novitsky et al [23] gender distribution was reported to be 67% females of the total patients. In the series of Appleton et al, [32] 75% of the patients were males.

Body Mass Index

The mean BMI of the patients in our study was 29.3-kgs/sq meter body surface area. Most of the patients (39 out of 43) in our study were either overweight (BMI 25 to <30) or obese (BMI 30 to <35). Just 4 (10%) patients were in the normal weight range (BMI less than 25).

Appleton et al [32] reported the mean BMI of the patients in their series to be 30.8-kegs/ sq meter body surface areas with the range being 19-34.4 kegs/ sq meters.

Thus the BMI of the patients in the present study was nearly similar to that reported by Appleton et al.[32]

Prevalence of Diabetes Mellitus

Diabetes has been a well-known factor for delaying the healing of any wound & thus proposed to be an important risk factor for incisional hernia development (Sugerman HJ et al [33]). In our study 14 (32.6%) out of the total of 43 patients were diabetic.

This finding is thus consistent with the findings of Sugerman HJ et al.[33]

Smoking status and Asthma

As smoking associated with chronic cough and also asthma have been proposed to be an important risk factor for incisional hernia development (Sorensen et al.[34]). In our study 4 patients had history of asthma and 2 were smokers, all having chronic cough consistent with

the findings of Sorensen et al [34], though spirometry revealed no abnormality.

Constipation and Prostatism

In the present study, out of 43 patients, 15 (34.9 %) patients had chronic constipation. Constipation, through increasing the intra-abdominal pressure, is a factor for incisional hernia development/progression (Bucknail TE et al).[35]

In this study 5 out of 15 male patients had evidence of symptoms suggestive of prostatism.

History of previous abdominal surgery

37.6% of our patients had the past history of laparotomy for intestinal perforation, while 18.6 % had history of previous hernia surgery.

In the study of Novitsky et al [23] recurrent ventral hernia was the most common indication for repair of abdominal wall (76.2%). Also the study conducted by Appleton et al [32] had 5 out of 12 patients with recurrent ventral hernia.

The reason likely might be an altogether different study population.

Symptoms urging the patients to go for repair surgery

The maximally prevalent symptoms among the patients wanting to get the current surgery for hernia repairs were cosmetic problems - 23 patients (53.4%), discomfort in daily life - 31 patients (72.09%) and chronic back pain- 11 patients (25.5%).

In the study of Novitsky et al [23] 71.4% patients had chronically incarcerated hernias.

Operation Time

In the present study the mean operation time was 254.7 minutes, ranging from 180 minutes to 330 minutes.

Novitsky et al [23] reported that in their series the mean time taken for surgery was 235 minutes (range 138-400 minutes).

In the study of Appleton et al [32] total operative time ranged from 150 to 550 min, with a mean of 383 minutes. The time taken was comparable to the study of Novitsky et al [23]

Hospital stay time

Patients in this study were hospitalized for a mean period of 9.7 days. In the series of Novitsky et al [23] the mean hospital stay time was 5.1 days whereas in the series of Appleton et al [32] it was 7.5 days, both having a shorter stay as compared to this study.

Short-term complications

Out of 43 patients in the study, 7 (16.3 %) patients developed short-term complication in the form of seroma, which was managed conservatively in all patients with removal of the sutures and use of i/v antibiotics, 5 (11.6 %) patients developed surgical site infection managed by iv antibiotics and regular dressings. There were no mesh related infections.

Novitsky et al [23] had reported that 24%(10) of their patients had developed wound complications, of which 7 were minor superficial wound infections that responded to antibiotics alone and 3 were major complications requiring surgical debridement, all the patients had an uneventful recovery. Appleton et al [32] reported wound infection in one patient and seroma formation in another patient.

Ko JH et al [36] tried to explain wide variations in the results of various workers. They have mentioned as under:

“One problem with outcome analyses after hernia repair is the lack of a common starting point for patients. In other words, midline hernias can be of various sizes, and patients differ in age, weight, tissue quality, wounds, and the need for concurrent bowel surgery. In addition, multicenter studies involving many patients introduce the added variables of the abilities and judgment of the surgeons. Because it is almost impossible to have the same starting point for all patients there are pre existing intra series & inter series variables.”

In our study none of the patients developed “abdominal compartment syndrome”. This observation is similar to the one in the series of “Novitsky et al”, [23] Appleton et al, [32] Pauli et al, [29] Petro et al [37] and Behar et al. [30] This finding is a very important point in the management of “Large Incisional Hernias” by “Transversus Abdominis Release”

which helps in restoring the functional anatomy of the anterior abdominal wall without causing significant physiological changes.

COMPLICATIONS DURING FOLLOWUP AFTER DISCHARGE

Occurrence of pain abdomen

During the hospital stay as well as on follow up for three months after discharge none of the patients developed any significant pain abdomen that could have been attributed to any complication of surgery.

Recurrence of hernia

Only one patient (2.3%) had recurrence of hernia in our study as seen on physical examination and sonology whereas recurrence reported by other authors are 4.7 % by Novitsky et al [23] and 3.6% by Krpata et al.[27]

Interference with daily life activities

During follow up of three months after discharge, 5 patients reported mild interference in daily activities like defecation, weight bearing or tying shoe-laces etc. However in general they were fully satisfied with the results of the surgery, and these minor problems could be handled easily with simple measures (like laxatives for constipation).

Appleton et al [32] also reported that their patients could perform daily life activities without limitations. Theoretically, the abdominal wall can become less flexible after synthetic mesh augmentation and can, therefore, cause more restrictions in daily life, as opposed to non-mesh repair. Appleton et al concluded that in their series, the application of mesh along with component separation did not create more limitations in daily life activities.

SUMMARY AND CONCLUSION

This study was conducted on 43 consenting patients with mid-line “large Incisional Hernia” with size of ≥10cms at its minimum width. They were treated with “TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE” and followed up for a period for 3 months.

The mean age of the patients was 58.4 years. There were more females as compared to males (65.1%, 28 out of 43 were females). The mean BMI of the patients in the study was 29.3-kg/sq meter body surface area. 14 (32.6%) patients had a history of Diabetes Mellitus Type 2. 4 patients had history of Asthma and 2 patients gave history of smoking though no evidence of COPD observed on spirometry. 15 (34.9%) patients had constipation and 5 patients of the 15 male patients had symptoms suggestive of prostatism. All the patients included in the study had large midline incisional hernia (with size > 10 cms. at its maximum width).

They were all treated surgically with “Transversus Abdominis Release Technique” and synthetic mesh was also applied.

The mean operation time was 254.7 minutes. The mean hospital stay time was 9.7 days, No patient developed “Hematoma”. 7 (16.3 %) patient developed seroma, 5 (11.6 %) patients developed surgical site infection, which were managed conservatively. There was no deep seated or mesh infection.

One (2.3%) patients developed recurrence of hernia during the follow up of three months.

In this study it is finally concluded that using the “Transversus Abdominis Release Technique” with good early post op outcomes without significantly altering the physiology of the abdominal wall can effectively treat “Large Incisional Hernias”.

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S. No.	Name	Age (years)	Gender (M/F)	CR No.	DoA	DoD	Present history					
							Swelling		Pain abdomen	Distention	Constipation	Vomitting
							Size (cm)	Reducibility				
1	SN	56	M	213589	1/2/2019	1/11/2019	11x8	YES	3	YES	YES	NO
2	TK	48	F	113146	1/13/2019	1/22/2019	10x9	YES	2	YES	NO	NO
3	DR	63	M	147737	1/28/2019	2/7/2019	10x6	YES	5	NO	NO	NO
4	ND	71	F	696977	2/27/2019	3/7/2019	12x10	YES	5	YES	YES	NO
5	KK	60	F	739640	3/31/2019	4/12/2019	12x10	YES	6	YES	NO	NO
6	PK	58	M	194212	4/12/2019	5/26/2019	10x10	YES	1	NO	NO	NO
7	SK	72	F	384113	5/7/2019	5/17/2019	12x11	YES	7	NO	NO	NO
8	SB	70	M	775588	5/9/2019	5/18/2019	10 x 5	YES	2	NO	NO	NO
9	L	49	M	808616	5/12/2019	5/19/2019	13x10	YES	3	NO	NO	NO
10	RP	55	M	319205	6/2/2019	13/06/209	11x12	YES	2	NO	NO	NO
11	RS	60	M	822205	6/7/2019	6/17/2019	11x7	YES	2	NO	YES	NO
12	AK	43	M	269088	6/8/2019	6/17/2019	10 x 5	YES	3	NO	YES	NO
13	RK	64	F	731571	6/20/2019	6/30/2019	12x8, 5x3	YES	4	NO	YES	NO
14	AR	48	F	724081	6/22/2019	7/2/2019	10x8	YES	7	NO	NO	NO
15	RK	65	M	637675	7/2/2019	7/10/2019	12x17	YES	4	NO	YES	NO
16	BK	56	F	908636	7/3/2019	7/16/2019	10x7	YES	1	NO	YES	NO
17	SC	58	F	913998	7/10/2019	7/17/2019	12x4	YES	3	NO	NO	NO
18	SD	50	F	931325	7/14/2019	7/24/2019	11x9	YES	5	YES	YES	NO
19	JS	71	M	729406	8/9/2019	3/18/2019	10X 7 , 7 x 5	YES	4	NO	YES	NO
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21	AK	63	M	888654	8/12/2019	8/22/2019	12X8	YES	1	YES	NO	NO
22	RK	55	F	745671	8/19/2019	8/28/2019	13X7	YES	7	NO	NO	NO
23	SR	61	F	740832	8/26/2019	9/5/2019	12X10	YES	5	YES	NO	NO
24	GK	68	F	690832	9/6/2019	9/14/2019	10x9	YES	6	YES	YES	NO
25	RK	43	M	618540	9/7/2019	9/14/2019	10x10	YES	1	NO	NO	NO
26	KJ	65	F	597331	9/20/2019	9/29/2019	12X6	YES	7	NO	NO	NO
27	KG	50	F	583220	9/21/2019	10/3/2019	11x9	YES	1	NO	NO	NO
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31	SK	53	F	786540	11-Nov	11/17/2019	10x10	YES	3	NO	NO	NO
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33	SM	69	F	853981	11/24/2019	12/3/2019	12x5	YES	2	NO	NO	NO
34	GS	70	M	8242162	12/3/2019	12/11/2019	10x7	YES	1	NO	NO	NO
35	MK	45	F	845111	12/14/2019	12/25/2019	10x10	YES	3	NO	NO	NO
36	TR	57	F	866155	12/15/2019	12/23/2019	18x8	YES	3	YES	NO	NO
37	RK	68	F	941210	1/5/2020	1/13/2020	10x12	YES	7	YES	YES	NO
38	RR	40	F	878423	1/7/2020	1/15/2020	13x10	YES	5	YES	YES	NO
39	MK	53	F	932187	2/20/2020	2/29/2020	13x8	YES	4	NO	YES	NO
40	RK	67	F	941236	2/26/2020	3/4/2020	11x9	YES	2	NO	NO	NO
41	KD	62	F	912442	3/7/2020	3/16/2020	12x11	YES	3	NO	NO	NO
42	AS	56	M	765428	3/9/2020	3/18/2020	11x11	YES	5	NO	YES	NO
43	FB	67	M	950630	4/10/2020	4/20/2020	10x9, 5x3	YES	6	YES	YES	NO

S. No.	Name	Age (years)			Past History		
			Chronic back pain	Discomfort	Date of lap and reason	Diabetes	Cough/ COPD
1	SN	56	5	6	Ventral hernia repair 8 years and 5 years back	NO	NO
2	TK	48	4	5	perforation peritonitis, stoma closure 12 years ago	NO	NO
3	DR	63	4	6	perforation peritonitis, stoma closure 3 years ago	NO	NO
4	ND	71	2	5	obstruction due to ileal striicture 5 years ago	NO	NO
5	KK	60	2	7	perforation peritonitis, stoma closure 7 years ago	YES	NO
6	PK	58	4	5	perforation peritonitis x 4 years	NO	NO
7	SK	72	1	4	ventral henria repair 10 years back	YES	NO
8	SB	70	3	6	laparotomy and stoma closure 15 years ago	YES	NO
9	L	49	2	1	ventral hernia repair 5 years ago	YES	NO
10	RP	55	4	6	ventral hernia repair 8 years ago and recurrent hernia repair 5 years ago	NO	NO
11	RS	60	7	5	traumatic perforation 7 years ago	NO	SMOKER
12	AK	43	4	6	perforation due to gunshot injury	NO	NO
13	RK	64	5	6	perforation peritonitis, stoma closure 5 years ago	YES	NO
14	AR	48	5	9	LSCS 15 years and 20 years back	NO	NO
15	RK	65	6	8	perforation 20 years back, hernia repair 10 years and 7 years back	NO	NO
16	BK	56	1	3	ventral hernia 6 years back	NO	NO
17	SC	58	3	4	LSCS 30 years and hernia repair 10 years back	NO	NO
18	SD	50	4	8	ventral hernia 5 years back	NO	NO
19	JS	71	4	6	laparotomy for gunshot15 years back and ventral hernia repair 10 years back	YES	NO
20	BK	58	6	3	LSCS 30 AND 35 YEARS BACK	NO	NO
21	AK	63	3	6	open chole 5 years back	NO	NO
22	RK	55	6	8	LSCSx26y;lap cholex2y	NO	NO
23	SR	61	2	6	open chole 6 years back	NO	NO
24	GK	68	2	7	CABG - 16 years back	YES	NO
25	RK	43	2	2	perforation peritonitis x 4 years	NO	NO
26	KJ	65	1	7	20 yrs back umbilical hernia repair	YES	NO
27	KG	50	7	4	hystrectomy 3 years back	YES	NO
28	SK	62	1	1	hystrectomy- 10y	NO	NO
29	V	65	4	7	TAH ć BSO x12y; hernia repair 9y	NO	ASTHMA
30	BK	47	2	5	hystrectomy 1yr back	NO	NO
31	SK	53	1	6	Intestinal TB, perforation, laparotomy 5 yrs	YES	NO
32	JS	48	5	9	LSCS 20 years back	YES	NO
33	SM	69	1	4	Recurrent hernia; perforation	NO	SMOKER
34	GS	70	1	5	CABG - 15 years back	YES	NO
35	MK	45	3	6	perforation peritonitis 10 years back, ventral hernia 8 years	NO	NO
36	TR	57	5	7	Iscs 31 years back	NO	ASTHMA
37	RK	68	2	8	perforation peritonitis x 3 years	NO	NO
38	RR	40	4	8	Open chole x 8 yrs	YES	ASTHMA
39	MK	53	1	6	TAH ć BSO nov 5 years back	NO	ASTHMA
40	RK	67	1	3	intestinal perforation 5 years back	NO	NO
41	KD	62	2	4	intestinal obstruction 5 years back	NO	NO
42	AS	56	1	3	ventral hernia repair 7 years ago	NO	NO
43	FB	67	6	5	perforation peritonitis, stoma closure 6 years ago	YES	NO

S. No.	Name	Age (years)					GPE						
			Connective tissue disease	Prostatism	Malignancy	Chemotherapy/ radiotherpay	Pulse	BP (mmHg)	Respiratory Rate	Temp (°F)	Height (cm)	Weight (kg)	BMI
1	SN	56	NO	YES	NO	NO	88	120/80	18	98	170	80	26
2	TK	48	NO	NO	NO	NO	96	130/70	16	98	168	63	22
3	DR	63	NO	NO	NO	NO	86	120/80	18	98	158	77	31
4	ND	71	NO	NO	NO	NO	72	130/80	14	98	155	65	27
5	KK	60	NO	NO	NO	NO	72	110/70	14	98	155	67	28
6	PK	58	NO	NO	NO	NO	88	130/80	14	98	165	80	30
7	SK	72	NO	NO	NO	NO	78	110/70	18	98	160	72	28
8	SB	70	NO	NO	NO	NO	74	110/70	20	98	160	78	30
9	L	49	NO	NO	NO	NO	76	120/80	16	98	160	80	31
10	RP	55	NO	NO	NO	NO	84	130/80	14	98	163	84	32
11	RS	60	NO	NO	NO	NO	70	110/70	16	98	165	72	27
12	AK	43	NO	NO	NO	NO	72	110/70	20	98	170	78	27
13	RK	64	NO	NO	NO	NO	86	130/80	18	98	160	80	31
14	AR	48	NO	NO	NO	NO	100	140/80	20	98	160	85	30
15	RK	65	NO	YES	NO	NO	90	110/80	14	98	163	72	27
16	BK	56	NO	NO	NO	NO	80	110/70	14	98	160	75	29
17	SC	58	NO	NO	NO	NO	88	130/90	14	98	166	93	34
18	SD	50	NO	NO	NO	NO	94	130/80	16	98	160	75	29
19	JS	71	NO	YES	NO	NO	86	130/80	16	98	164	65	24
20	BK	58	NO	NO	NO	NO	72	110/60	20	98	160	82	32
21	AK	63	NO	YES	NO	NO	96	130/70	14	98	168	63	22
22	RK	55	NO	NO	NO	NO	86	120/80	16	98	158	77	31
23	SR	61	NO	NO	NO	NO	72	130/80	12	98	155	65	27
24	GK	68	NO	NO	NO	NO	72	110/70	12	98	155	67	28
25	RK	43	NO	NO	NO	NO	88	130/80	18	98	165	80	30
26	KJ	65	NO	NO	NO	NO	78	110/70	16	98	160	72	28
27	KG	50	NO	NO	NO	NO	74	110/70	16	98	160	78	30
28	SK	62	NO	NO	NO	NO	76	120/80	20	98	160	64	25
29	V	65	NO	NO	NO	NO	70	110/70	20	98	163	78	29
30	BK	47	NO	NO	NO	NO	88	110/70	14	98	160	85	34
31	SK	53	NO	NO	NO	NO	72	110/70	12	98	158	66	27
32	JS	48	NO	NO	NO	NO	100	150/90	16	98	160	85	30
33	SM	69	NO	NO	NO	NO	90	110/80	16	98	163	80	30
34	GS	70	NO	YES	NO	NO	80	110/70	18	98	165	87	33
35	MK	45	NO	NO	NO	NO	114	130/90	20	98	163	93	35
36	TR	57	NO	NO	NO	NO	90	120/80	12	98	170	106	37
37	RK	68	NO	NO	NO	NO	108	190/100	14	98	158	70	28
38	RR	40	NO	NO	NO	NO	94	130/80	14	98	158	75	30
39	MK	53	NO	NO	NO	NO	86	130/80	16	98	164	65	24
40	RK	67	NO	NO	NO	NO	72	110/60	18	98	160	82	32
41	KD	62	NO	NO	NO	NO	86	120/80	14	98	164	88	33
42	AS	56	NO	NO	NO	NO	84	130/80	12	98	170	86	30
43	FB	67	NO	NO	NO	NO	78	150/90	16	98	174	98	32

S. No.	Name	Age (years)		systemic exam\						
			Waist (cm)	Chest	CVS	CNS	Site	Distention	Tenderness	Abdominal girth (cm)
1	SN	56	100	NAD	NAD	NAD	umbilical	NO	NO	110
2	TK	48	88	NAD	NAD	NAD	periumbilical	mod	NO	110
3	DR	63	120	NAD	NAD	NAD	mid abdomen	NO	NO	120
4	ND	71	118	NAD	NAD	NAD	umbilical	mild	NO	130
5	KK	60	101	NAD	NAD	NAD	mid abdomen	NO	NO	130
6	PK	58	110	basal crepts	NAD	NAD	periumbilical	NO	NO	112
7	SK	72	110	NAD	NAD	NAD	umbilical	mild	NO	120
8	SB	70	110	NAD	NAD	NAD	midline	mild	NO	114
9	L	49	100	NAD	NAD	NAD	midline	NO	NO	110
10	RP	55	115	NAD	NAD	NAD	midline	NO	NO	120
11	RS	60	108	B/L basal rhonchi	NAD	NAD	midline	NO	NO	110
12	AK	43	100	NAD	NAD	NAD	midine, stomal site	NO	NO	122
13	RK	64	104	NAD	NAD	NAD	midine, stomal site	NO	NO	110
14	AR	48	120	NAD	NAD	NAD	lower abdomen	mild	NO	118
15	RK	65	114	NAD	NAD	NAD	midline	NO	NO	114
16	BK	56	118	NAD	NAD	NAD	epigastric and umbilical	NO	NO	120
17	SC	58	118	NAD	NAD	NAD	infraumbilical	NO	NO	120
18	SD	50	118	NAD	NAD	NAD	periumbilical	mild	NO	120
19	JS	71	95	NAD	NAD	NAD	supraumbilical and infraumbilical	NO	NO	98
20	BK	58	114	NAD	NAD	rt facial palsy	infra umbilical	NO	NO	115
21	AK	63	88	NAD	NAD	NAD	perumbilical	NO	NO	110
22	RK	55	120	NAD	NAD	NAD	upper abdomen	NO	NO	120
23	SR	61	118	NAD	NAD	NAD	peraumbilical	NO	NO	130
24	GK	68	101	NAD	NAD	NAD	epigastric	NO	NO	100
25	RK	43	110	basal crepts	NAD	NAD	periumbilical	NO	NO	112
26	KJ	65	110	NAD	NAD	NAD	umbilical	mild	NO	105
27	KG	50	110	crepts	NAD	NAD	paraumbilical	NO	NO	114
28	SK	62	95	NAD	NAD	NAD	periumbilical	NO	NO	110
29	V	65	108	NAD	NAD	NAD	supraumbilical	NO	NO	110
30	BK	47	104	NAD	NAD	NAD	infraumbilical	NO	NO	104
31	SK	53	120	NAD	NAD	NAD	periumbilical	NO	NO	132
32	JS	48	120	NAD	NAD	NAD	lower abdomen	NO	NO	118
33	SM	69	114	crepts	NAD	NAD	periumbilical	NO	NO	114
34	GS	70	118	NAD	NAD	NAD	epigastric	NO	NO	120
35	MK	45	118	NAD	NAD	NAD	infraumbilical	NO	NO	120
36	TR	57	145	NAD	NAD	NAD	hypogastrium	NO	NO	145
37	RK	68	100	crepts	NAD	NAD	infraumbilical	NO	NO	110
38	RR	40	118	NAD	NAD	NAD	periumbilical	mod	NO	120
39	MK	53	95	NAD	NAD	NAD	supraumbilical	NO	NO	98
40	RK	67	114	NAD	NAD	NAD	infra umbilical	NO	NO	115
41	KD	62	108	NAD	NAD	NAD	infra umbilical	NO	NO	110
42	AS	56	110	NAD	NAD	NAD	supraumbilical and infraumbilical	NO	NO	114
43	FB	67	118	NAD	NAD	NAD	midline and stoma site	mild	NO	120

S. No.	Name	Age (years)	Max. width (cm)	Area (sqcm)	Reducibility	Overlying skin	Bowel sounds	Hb	TLC	D L C	Platelet count	Urea
1	SN	56	12	144	YES	Normal	Normal	12.7	7.3	54/36/7/3	322,000	23
2	TK	48	15	225	YES	Normal	Normal	13.4	6.1	53/38/7/2	278,000	18
3	DR	63	15	225	YES	Normal	Normal	12.1	6.4	59/27/10/4	244,000	13
4	ND	71	15	225	YES	Normal	Normal	14.4	9.7	63/25/10/2	351,000	16
5	KK	60	12	144	YES	Normal	Normal	11.8	9.8	64/25/8/3	412,000	12
6	PK	58	10	100	YES	Normal	Normal	15.6	7.8	50/36/11/5	251,000	24
7	SK	72	12	144	YES	Normal	Normal	12.2	12.3	61/30/7/2	226,000	30
8	SB	70	20	400	YES	Normal	Normal	11	7.2	55/34/8/2	294,000	21
9	L	49	13	169	YES	Normal	Normal	12	13	53/38/8/1	247,000	17
10	RP	55	12	144	YES	Normal	Normal	15	6.2	59/30/8/2	270,000	29
11	RS	60	16	256	YES	Normal	Normal	10.6	7.8	63/25/10/2	312,000	36
12	AK	43	10	100	YES	Normal	Normal	13.5	8	54/34/9/4	223,000	23
13	RK	64	11	121	YES	Normal	Normal	12.6	9.2	64/22/12/3	335,000	36
14	AR	48	10	100	YES	Normal	Normal	12.5	5.4	60/25/12/5	320,000	20
15	RK	65	17	289	YES	Normal	Normal	14.4	6.7	59/30/9/1	198,000	19
16	BK	56	10	100	YES	Normal	Normal	11.6	10.8	78/17/2/1	212,000	18
17	SC	58	11	121	YES	Normal	Normal	11.9	10.8	73/20/5.7/1.2	262,000	38
18	SD	50	10	100	YES	Normal	Normal	11.5	6.6	58/31/6/4	301,000	36
19	JS	71	12	144	YES	Normal	Normal	11.4	10.4	84/6/9/0	262,000	36
20	BK	58	14	480	YES	Normal	Normal	13.3	8.9	59/27/10/4	178,000	22
21	AK	63	12	144	YES	Normal	Normal	10.8	8.3	71/19/6/2	212,000	24
22	RK	55	11	121	YES	Normal	Normal	8.8	16.1	91/6/1/1	310,000	12
23	SR	61	12	144	YES	Normal	Normal	14.7	9.1	61/30/6/2	223,000	96
24	GK	68	10	100	YES	Normal	Normal	11.9	7.1	61/27/9/2	320,000	24
25	RK	43	10	100	YES	Normal	Normal	15.4	12.3	76/9/10/3	450,000	34
26	KJ	65	12	144	YES	Normal	Normal	9	6.7	85/9/2/2	245,000	67
27	KG	50	11	121	YES	Normal	Normal	11.7	8.5	52/42/5/2	400,000	22
28	SK	62	10	100	YES	Normal	Normal	12	6.3	65/23/9/1	190,000	31
29	V	65	10	100	YES	Normal	Normal	10.2	11.3	87/9/2	182,000	21
30	BK	47	17	289	YES	Normal	Normal	12.4	6.7	43/47/6/3	267,000	20
31	SK	53	10	100	YES	Normal	Normal	12.8	7.6	62/29/5/1	345,000	25
32	JS	48	10	100	YES	Normal	Normal	9.1	13.6	64/28/5/2	390,000	21
33	SM	69	12	144	YES	Normal	Normal	13.2	12.5	70/17/10/1	310,000	16
34	GS	70	10	100	YES	Normal	Normal	14.4	6.2	51/31/10/6	412,000	27
35	MK	45	10	100	YES	Normal	Normal	8	11.3	65/25/5/4	523,000	18
36	TR	57	18	324	YES	Normal	Normal	11.4	12.2	68/23/5/2	320,000	18
37	RK	68	12	144	YES	Normal	Normal	13.9	3.9	85/12/1/2	250,000	74
38	RR	40	13	169	YES	Normal	Normal	11.5	6.7	67/25/4/2	150,000	24
39	MK	53	13	169	YES	Normal	Normal	12.6	8.9	65/28/5/2	196,000	25
40	RK	67	11	121	YES	Normal	Normal	11	3.9	58/27/10/3	200,000	32
41	KD	62	12	144	YES	Normal	Normal	12.1	8.9	50/32/8/8	380,000	42
42	AS	56	11	121	YES	Normal	Normal	13.8	6.2	65/25/3/5	428,000	34
43	FB	67	15	225	YES	Normal	Normal	11	9	70/15/12/1	367,000	21

S. No.	Name	Age (years)	investigations		
			Creatinine	PTIINR	Imaging study
1	SN	56	0.76	12.0/1.10	CECT Abd- 10.8 x 6.1cm wall defect, no obst
2	TK	48	0.51	11.8/1.08	ct-defect of 10.2 x 9 cm with small bowel as content, nrmal musculature
3	DR	63	1.08	10.1/0.93	CECT Abd- 10cm wall defect, no obst
4	ND	71	0.62	12.3/1.13	CECT- 10.6x 9 cm defec, no obst
5	KK	60	0.58	12.0/1.10	CECT- 11.5x 11 cm defec, no obst, muscles thinned
6	PK	58	1.14	10.5/0.96	CECT- 10.1x 10.2 cm defect, no obst
7	SK	72	0.8	10.7/0.98	CECT- 2 defects one 12 x 9 cm and one 3 x 1 cm
8	SB	70	0.81	12.2/1.12	CECT- 2 defects one 10 x 7 cm and one 5 x 4 cm stoma site
9	L	49	0.8	11.6/1.06	CECT- 13.6x 10.2 cm defect, no obst
10	RP	55	0.6	9.8/0.90	CECT Abd- 12.5 x 11.1cm wall defect, no obst
11	RS	60	1.1	12.2/1.10	CECT Abd- 11.3 x 8.6cm wall defect, no obst
12	AK	43	0.79	10.5/0.96	CECT- 2 defects one 11 x 7 cm and one 7 x 4 cm stoma site
13	RK	64	0.52	12.9/1.3	CECT- 2 defects one 11.5 x 8 cm and one 7 x 6 cm stoma site
14	AR	48	0.5	10.6/1.0	CECT Abd- 10.5 x 5.1cm wall defect, no obst
15	RK	65	1.01	12.2/1.11	CECT Abd- 17.1 x 12.1cm wall defect, no obst
16	BK	56	0.67	11.6/1.02	CECT Abd- 10.7 x 7.8cm wall defect, no obst
17	SC	58	0.76	9.8/0.90	CECT Abd- 10.3 x 5.8cm wall defect infraumbilical, no obst
18	SD	50	0.58	11.7/1.08	CECT Abd- 10.7 x 7.8cm wall defect, no obst
19	JS	71	1.13	11.6/0.4	CECT- 2 defects one 10 x 7 cm supraumbilical and one 5 X 7 cm infraumbilical
20	BK	58	0.56	11.7/1.08	CECT Abd- 14.2 x 8.1cm wall defect, no obst
21	AK	63	1.25	11.6/1.07	CECT Abd-11 x 9 cm defect right upper quadrant, transverse colon and liver content
22	RK	55	0.11	11.0/1.01	CECT Abd- 13.2x 7 cm defect, no obst.
23	SR	61	1.43	12.1/1.1	CECT Abd- 12 x 10.3 cm wall defect, no obst.
24	GK	68	0.68	13.1/1.28	CECT Abd- 10 x 9.7 cm wall cm defect, no obst.
25	RK	43	1.8	10.5/0.99	CECT Abd- 10.5 x 10 cm wall cm defect, no obst, normal muscles
26	KJ	65	3	12.6/1.20	CECT Abd- 12.2 x 6.8 cm defect, no obst.
27	KG	50	0.54	12.3/1.13	CECT Abd- 11.3 x 9.1 cm defect, no obst.
28	SK	62	0.76	11.8/1.08	CECT Abd- 10.3x8.1 cm defect, no obst.
29	V	65	0.64	10.6/1.0	CECT Abd- 10.2x 7 cm defect, no obst.
30	BK	47	0.76	10.5/0.99	CECT Abd- 17.2 x 7.5 cm defect, no obst.
31	SK	53	0.71	10.9/1.0	CECT Abd- 10.3 x 10 cm defect, no obst.
32	JS	48	0.67	12.2/1.10	CECT Abd- 10 x 8.1 cm defect, no obst.
33	SM	69	0.93	13.4/1.3	CECT Abd- 12.4 x 5.5 cm defect, no obst.
34	GS	70	1.03	12.0/1.10	CECT Abd- 10.6x 7 cm defect, no obst.
35	MK	45	0.47	10.5/0.96	CECT Abd- 10.1 x 10 cm defect, no obst.,normal muscles
36	TR	57	0.73	10.7/0.98	CECT Abd- 18 x8.4 cm defect, no obst.
37	RK	68	0.91	12.2/1.12	CECT Abd- 12 x 10.3 cm defect, no obst.
38	RR	40	0.58	11.6/1.06	CECT Abd- 13.2 x 10 cm defect, no obst.
39	MK	53	0.31	12.6/1.20	CECT Abd- 13 x 8 cm defect, no obst.
40	RK	67	0.58	12.3/1.13	CECT Abd- 11.1 x 9 cm defect, no obst.
41	KD	62	0.72	11.8/1.08	CECT Abd- 12 x 11 cm defect, no obst.
42	AS	56	0.8	11.3/1.12	CECT Abd- 11.2 x 11 cm defect, no obst.
43	FB	67	0.62	12.3/1.13	CECT Abd- 10.3 x 9 cm defect and 1 defect 5 x 3 cm parastomal

S. No.	Name	Age (years)		intra op						
			Other invest	Steps	Mesh size and site	Midline approx	Duration of surgery (min)	Hematoma	Seroma	Infection
1	SN	56	-	B/L TAR	30x30cm, PREFASCIAL	YES	285	NO	YES	NO
2	TK	48	-	B/L TAR	30x30cm, PREFASCIAL	YES	240	NO	NO	NO
3	DR	63	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	255	NO	NO	YES
4	ND	71	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	285	NO	YES	NO
5	KK	60	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	300	NO	NO	NO
6	PK	58	-	B/L TAR	30x30cm, PREFASCIAL	YES	225	NO	NO	NO
7	SK	72	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	300	NO	NO	NO
8	SB	70	ECHO - LVH,mildAR	B/L TAR	30x30cm, PREFASCIAL	YES	255	NO	NO	NO
9	L	49	-	B/L TAR	30x30cm, PREFASCIAL	YES	180	NO	YES	NO
10	RP	55	-	B/L TAR	30x30cm, PREFASCIAL	YES	270	NO	NO	YES
11	RS	60	SPIROMETRY- WNL	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	NO
12	AK	43	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	270	NO	YES	NO
13	RK	64	-	B/L TAR	30x30cm, PREFASCIAL	YES	300	NO	NO	NO
14	AR	48	-	B/L TAR	30x30cm, PREFASCIAL	YES	195	NO	NO	NO
15	RK	65	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	330	NO	NO	NO
16	BK	56	-	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	NO
17	SC	58	-	B/L TAR	30x30cm, PREFASCIAL	YES	225	NO	NO	NO
18	SD	50	-	B/L TAR	30x30cm, PREFASCIAL	YES	330	NO	NO	NO
19	JS	71	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	240	NO	YES	NO
20	BK	58	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	NO
21	AK	63	-	B/L TAR	30x30cm, PREFASCIAL	YES	270	NO	NO	NO
22	RK	55	-	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	NO
23	SR	61	-	B/L TAR	30x30cm, PREFASCIAL	YES	300	NO	NO	NO
24	GK	68	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	330	NO	NO	NO
25	RK	43	-	B/L TAR	30x30cm, PREFASCIAL	YES	180	NO	NO	NO
26	KJ	65	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	255	NO	NO	NO
27	KG	50	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	YES
28	SK	62	-	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	NO
29	V	65	SPIROMETRY- WNL	B/L TAR	30x30cm, PREFASCIAL	YES	240	NO	NO	NO
30	BK	47	-	B/L TAR	30x30cm, PREFASCIAL	YES	285	NO	YES	NO
31	SK	53	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	330	NO	NO	NO
32	JS	48	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	225	NO	NO	NO
33	SM	69	SPIROMETRY-WNL	B/L TAR	30x30cm, PREFASCIAL	YES	300	NO	NO	NO
34	GS	70	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	255	NO	NO	NO
35	MK	45	-	B/L TAR	30x30cm, PREFASCIAL	YES	180	NO	NO	YES
36	TR	57	SPIROMETRY-WNL	B/L TAR	30x30cm, PREFASCIAL	YES	270	NO	NO	NO
37	RK	68	-	B/L TAR	30x30cm, PREFASCIAL	YES	210	NO	NO	NO
38	RR	40	ECHO-N, SPIROMETRY-WNL	B/L TAR	30x30cm, PREFASCIAL	YES	270	NO	NO	NO
39	MK	53	SPIROMETRY- WNL	B/L TAR	30x30cm, PREFASCIAL	YES	240	NO	NO	NO
40	RK	67	-	B/L TAR	30x30cm, PREFASCIAL	YES	255	NO	NO	NO
41	KD	62	-	B/L TAR	30x30cm, PREFASCIAL	YES	285	NO	NO	NO
42	AS	56	-	B/L TAR	30x30cm, PREFASCIAL	YES	300	NO	YES	NO
43	FB	67	ECHO-N	B/L TAR	30x30cm, PREFASCIAL	YES	225	NO	NO	YES

S. No.	Name	Age (years)				
			Drain removal on day	Duration of stay (days)	Pain abdomen	Recurrence
1	SN	56	8	9	1	NO
2	TK	48	5	9	2	NO
3	DR	63	5	10	1	NO
4	ND	71	7	9	1	NO
5	KK	60	5	13	2	YES
6	PK	58	5	13	1	NO
7	SK	72	5	11	1	NO
8	SB	70	6	10	2	NO
9	L	49	10	11	1	NO
10	RP	55	7	11	2	NO
11	RS	60	7	11	2	NO
12	AK	43	6	10	2	NO
13	RK	64	7	11	1	NO
14	AR	48	5	9	1	NO
15	RK	65	8	9	2	NO
16	BK	56	8	6	2	NO
17	SC	58	7	8	2	NO
18	SD	50	6	11	1	NO
19	JS	71	9	7	1	NO
20	BK	58	5	8	2	NO
21	AK	63	5	11	1	NO
22	RK	55	5	10	1	NO
23	SR	61	6	11	1	NO
24	GK	68	7	9	1	NO
25	RK	43	5	8	2	NO
26	KJ	65	5	10	2	NO
27	KG	50	9	13	1	NO
28	SK	62	6	8	1	NO
29	V	65	5	11	2	NO
30	BK	47	7	8	2	NO
31	SK	53	6	8	1	NO
32	JS	48	6	9	2	NO
33	SM	69	5	10	1	NO
34	GS	70	6	9	1	NO
35	MK	45	8	12	2	NO
36	TR	57	5	9	2	NO
37	RK	68	5	9	1	NO
38	RR	40	5	9	3	NO
39	MK	53	5	10	2	NO
40	RK	67	5	8	1	NO
41	KD	62	6	10	1	NO
42	AS	56	9	10	1	NO
43	FB	67	10	11	2	NO

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The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.05.2019 has approved the plan of thesis of **Raghav Khurana**, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis

Evaluation of the transversus abdominis release technique for repair of large ventral hernia

Supervisor
Dr. Jaspal Singh
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DMCH, Ludhiana.

Co-Supervisor
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The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

PROSPECTIVE STUDY OF EVALUATION OF TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

Master of Surgery

In

GENERAL SURGERY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

SEPTEMBER, 2018

DR. RAGHAV KHURANA

DEPARTMENT OF GENERAL SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	"EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA"
For the degree of	M.S. (GENERAL SURGERY)
Name of the candidate	Dr. Raghav Khurana
Supervisor	Dr. Jaspal Singh, Professor and Head, Department of General Surgery,DMCH, Ludhiana
Co-supervisor	Dr. Sanjeev Singla, Professor, Department of General Surgery, DMCH, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot.

Introduction: Hernias of the anterior abdominal wall, or ventral hernias, represent defects in the parietal abdominal wall fascia and muscle through which intra-abdominal or pre-peritoneal contents can protrude. Ventral hernias may be congenital or acquired. Acquired hernias may develop via slow architectural deterioration of the muscular aponeuroses or they may develop from failed healing of an anterior abdominal wall incision after laparotomy.

Aim of Study: To evaluate the clinical outcome in patients with "Large Ventral Hernia", repaired using "Transversus Abdominis Release Technique"

Materials & Methods: The study will be conducted on patients with "large ventral hernia", admitted to the "Department of Surgery, DMC Hospital, Ludhiana" during the period "November 1, 2018 to April 30, 2020". The clinical outcome in patients will be measured in terms of: operation time; hematoma seroma; infection; recurrence of hernia (by ultrasound abdomen); any other complication The patients will be followed up during the hospital stay as well as for a period of three months after discharge from the hospital. Descriptive statistical studies will be used to evaluate the data collected. **Inclusion criteria:** 1.The patients admitted with mid-line "large ventral hernia" with size of ≥10 cms. at its maximum width and/ or ≥50 sq. cms in its surface area. 2. Patients consenting to participate in the study. **Exclusion Criteria:** Pregnancy, Peritonitis, Patients on Immunosupressives, Patients already suffering from left heart failure, chronic liver disease, renal failure or COPD, Pre existing Enterocutaneous Fistula or skin defect.

Clinical Significance: Ventral hernias pose a surgical dilemma in today's times and it has become essential to define that which technique is best suited for treatment of large ventral hernias with least complications and least recurrence rate.

Keywords: Ventral hernia, Transversus Abdominis Release.

(Signature)
Candidate

(Signature)
Co-supervisor

(Signature)
Supervisor

(Signature)
Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA"** exist in the Department of General Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate himself under our supervision and guidance.

Supervisor

Dr. Jaspal Singh
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Place: LUDHIANA

Date: 12/12/2018

APPROVAL PROFORMA
BY RESEARCH & ETHICS COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of Candidate	Dr. Raghav Khurana
Department	General Surgery
Topic of Thesis	Evaluation of the Transversus Abdominis Release technique for repair of large ventral hernia
Likely date of appearing in PG examination	May 2021
Date of enrollment	May 10, 2018
Name of Head of Department	Dr. Jaspal Singh
1) Supervisor **2) Co-Supervisor**	Dr. Jaspal Singh Dr. Sanjeev Singla
Signatures of Members of Research Committee with Stamp	**Signatures of Members of Ethical Committee with Stamp**
1.HOD Pharmacology	1. HOD Physiology
2.HOD Surgery	2. HOD Pathology
3.HOD Pathology	3. HOD Pharmacology
4.HOD Medicine	4. HOD SPM
5.Dean Academics	5. HOD Medicine
6.Vice Principal	6. HOD Surgery
	7. HOD Obst. &Gynae
	8. Legal Expert
	9. Dean Academics
	10. Secretary, IEC
	11.Vice Principal
	12. Principal

Approved: Yes/No

Chairperson
Research Committee

Chairperson
Research Committee

Approved: Yes/No

Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	Dr. Raghav Khurana Khurana hospital, near railway crossing, Kalka road, Pinjore, Distt. Panchkula, Haryana. 134102
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
3	COURSE OF STUDY AND SUBJECT	M.S. GENERAL SURGERY
4	DATE OF ADMISSION OF COURSE	10th May 2018
5	TITLE OF THE TOPIC	"Evaluation of the Transversus Abdominis release technique for repair of large ventral hernia"

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR STUDY

Hernias of the anterior abdominal wall, or ventral hernias, represent defects in the parietal abdominal wall fascia and muscle through which intra-abdominal or pre-peritoneal contents can protrude. Ventral hernias may be congenital or acquired. Acquired hernias may develop via slow architectural deterioration of the muscular aponeuroses or they may develop from failed healing of an anterior abdominal wall incision after laparotomy.

Incisional hernia remains a frequent complication of abdominal surgery with a reported incidence of 2-20%.[1-3] Further reports indicate that 3-20% of the patients undergoing laparotomy will go through additional surgery to repair an incisional hernia [4] because of various indications. The associated morbidity secondary to incarceration, strangulation & bowel obstruction is significant. Out of the patients undergoing incisional hernia repair, strangulation or incarceration is the indication for repair in 17% of such patients.[5] Less alarming symptoms are: recurrent intestinal obstruction, atrophic apical or intertrigous peripheral skin coverage of the hernial sac, chronic back pain or cosmetic complaints.

In long standing hernia, a considerable amount of the abdominal contents will lose its "abdominal domain" due to abdominal wall weakness & lateral retraction of the muscles. This will lead to adverse effects on posture maintenance, respiration, micturition, defecation & biomechanical properties, which have a profound impact on patient's overall physical capacity & quality of life. When morbidity is added to the vast numbers & the tremendous costs

associated with hernia repair, it becomes clear that the efficacy of ventral hernia repair is of major importance.

Ventral hernia repair has become an increasingly difficult problem and typical reconstructive techniques have struggled to re establish abdominal domain and to create a lasting repair with there being high recurrence rates after Anterior component separation including a high risk of wound infections and flap necrosis due to division of Para Umbilical Perforator Sparing vessels.

Due to the drawbacks of Anterior CST and unacceptable complication rate a new surgical technique needed to be developed. Transversus Abdominis release repair a modification of the Rives-Stoppa technique is now being increasingly used to manage large ventral hernias and has shown promising results.

Transversus Abdominis muscle release is a versatile technique of hernia repair that offers a reliable, durable solution to complex abdominal wall construction with low recurrence rates and lower morbidity and decreased rates of surgical site infection.[6] Transversus Abdominis release can be utilized for repair of large ventral hernias (>10cm) which pose a challenge to the surgeon.

Posterior component separation by Transversus Abdominis release seems to be the ideal approach for complex ventral hernias with good immediate outcomes.[7]

In view of the challenging management of large ventral hernias and promising early results shown by the Transversus Abdominis release technique in their management, this study is being planned.

6.2 REVIEW OF LITERATURE

Hernia repair has undergone vast evolution in the last 5 decades. Surgeons have embarked on an incessant search for the "optimal approach" to repair ventral hernias, driven perhaps by their patients' frustration as well as their own when faced with a failed repair after what initially looked like the "perfect surgery." These efforts have led to remarkable accomplishments in hernia surgery. With the unacceptable rates of hernia recurrence seen with primary fascial repairs, the first revolution in hernia surgery came with the concept of the fascial closure with mesh. Soon enough, mesh repair became the gold standard for elective ventral hernia repair. The second revolution came later when, still uncomfortable with persisting high rates of recurrence despite the use of mesh, Dr's Rene Stoppa, Jean Rives, and George Wantz explored the retromuscular and preperitoneal planes of the abdominal wall, contributing to significant refinements in surgical techniques.

Mesh now could be placed in a space that was well-vascularized and entirelyexcluded from the bowel. This technique, although unknown at that time, was the first true myofascial release, because it involved releasing the rectus muscle from its fascial compartment and provided 5 cm of medial advancement on each side of the abdomen.[8] Developed by Dr Jean Rives and Rene Stoppa in the 1960s, and later popularized by Dr George Wantz, the Rives-Stoppa retromuscular repair still remains the gold standard open approach for incisional hernia repair owing to its superior durability and lower wound complications rates when compared with other open approaches.[8] The principles of placing the mesh in a well-vascularized space favoring mesh incorporation and in addition completely excluding the prosthesis from

intraabdominal contents mitigating mesh related complications have leveraged the adoption of this technique. In addition, having intraabdominal pressure forcing the prosthesis against the rectus muscle and, thus,supporting mesh incorporation into the abdominalwall was also the biomechanical principleinvolved in the rationale of this technique to decrease hernia recurrence.[8] A retromuscular hernia repair is primarily based on freeing the rectus muscle from its fascial compartment by releasing the posterior rectus sheath from its ventral insertion into the linea alba, and sequentially dissecting the muscle off the fascia laterally. This procedure ultimately allows for a medial advancement of the linea alba of up to 5 cm at the level of the umbilicus and 3 cm above and below the umbilicus. Without any further complicated component separation, this simple myofascial release of the rectus muscle should be enough to adequately provide a tension-free fascial closure for defects of less than 10 cm in width. In addition, the creation of a retrorectus pocket provides adequate space for mesh positioning secluded from intraabdominal contents. Byclosing the anterior fascia on top of the mesh, the prosthesis is protected from the more superficial layers of the wound, decreasing risk for mesh infection.[8,9] More important; the Rives-Stoppa retromuscular repair does not require the creation of subcutaneous flaps and, therefore, can help to minimize wound complications and mesh exposure in case of wound breakdown.

Although the Rives-Stoppa retromuscular repair has gained popularity and became the global "standard approach" for incisional hernia repairs, it still was not sufficient to adequately fix larger and more complex defects.

Dr Oscar Ramirez was responsible for starting the third revolution in hernia surgery by describing the anatomic components separation of the abdominal wall [10], which became what is now known as "abdominal wall reconstruction." He described the anterior components separation that involved the release of the external oblique muscle and fascia to achieve medial advancement. The approach of anterior component separation (ACS) as described by Ramirez, despite its wide fascial advancement and improved functional outcomes is encumbered by a significant wound morbidity at rates as high as 50% even in the presence of peri-umbilical perforators sparing.[11,12] Minimally invasive surgery modifications reduced surgical site events but could not improve the recurrence rate.[13] Subsequent modification of this technique arose, each with its own set of disadvantages. This technique allowed for significant myofascial advancement and wide mesh overlap in the sublay position, while preserving blood supply to subcutaneous tissue and skin. As the number of large and complex abdominal wall defects is increasing it is obvious that the procedure of Anterior Component Separation is not adequate for such pathology. Some modifications of the technique were reported but the limited advancement of the rectus Abdominis muscle make them inappropriate.[14,15]

In 2012 Novitsky et al reported a novel approach to posterior component separation by Transversus Abdominis muscle release.[16] This is a lateral extension of Rives – Stoppa repair with the creation of a wide space between the Transversus Abdominis muscle and fascia transversalis- peritoneum complex. Transversus Abdominis release is gaining popularity due to initially promising results. The technique is a modification of the classical Rives-Stoppa technique, the Transversus Abdominis muscle is released medial to

the linea semilunaris to expose a broad plane that extends from the central tendon of the diaphragm superiorly, to the space of Retzius inferiorly, and laterally to the retroperitoneum .this preserves the neurovascular bundles innervating the medial abdominal wall. Mesh is placed in a sublay fashion above the posterior layer. In an overwhelming majority of patients, the linea alba is reconstructed, creating a functional abdominal wall, the most important aspect of hernia repair surgery, with wide mesh reinforcement. The technique is reliable and durable, with a 5 percent recurrence rate at 2 years.[15] Although wound complications occur with a frequency similar to that of other techniques, they tend to be less severe, rarely requiring operative debridement.

While there are no randomised control trial data regarding Transversus Abdominis muscle release technique, Novitsky et al, from their single specialist hernia unit in the USA, have published their outcomes of 347 patients at mean follow-up of at least 1 year, showing a recurrence rate of 3.7% and a surgical site infection rate of 9.1% [16], which as compared to Anterior component separation technique where with Reilingh TS et al [17] reporting a rate of 12-67%, including hematoma, seroma, skin necrosis & infection.

Initial results were published by Novitsky and associates in 2012 [16], created great enthusiasm in the surgical community. Initial experience showed a deep surgical site infection rate of 7% and a recurrence rate of 4.7% after a median 26 months of follow-up. In the same year, Krpata and colleagues [18] compared the Transversus Abdominis release retrospectively with open anterior component separation with sublay mesh, and showed that the Transversus Abdominis release could achieve equivalent rates of fascial

closure when compared with anterior component separation, but with a significantly lower rate of wound complications. Although recurrence rates were higher in the anterior component separation group, this difference was not sufficient to reach statistical significance, and the median follow-up period was relatively short. Since then, the procedure has gained great popularity, and several other series have been published reporting consistent outcomes. In fact, the safety and feasibility of the technique have been tested inchallenging patient cohorts like those with complex parastomal hernias [19,20], hernias after open abdomen [21], and hernias after kidney transplantation.[22] The latest innovation in Transversus Abdominis release involved minimally invasive approaches, especially with the robotic platform.[23] Robotic assisted Transversus Abdominis release seems to result in a shorter duration of hospital stay when compared with the traditional open approach. However there are insufficient data to draw meaningful conclusions and surgeons are still overcoming the learning curve of the robotic Transversus Abdominis release as evidenced by the significantly longer operative times.[25]

6.3 AIMS & OBJECTIVES

To evaluate the clinical outcome in patients with "Large Ventral Hernia", repaired using "Transversus Abdominis Release Technique".

7. MATERIAL & METHOD

7.1 SOURCE OF DATA

The study will be conducted on patients with "large ventral hernia", admitted to the "Department of Surgery, Dayanand Medical College and Hospital, Ludhiana" during the period "November 1, 2018 to April 30, 2020".

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

1. The patients admitted with mid-line "large ventral hernia" with size of ≥10 cms. at its maximum width and/ or ≥50 sq. cms in its surface area.
2. Patients consenting to participate in the study.

EXCLUSION CRITERIA

1. Pregnancy.
2. Peritonitis.
3. Patients on immunosuppressives or suffering from cancer.
4. Patients already suffering from left heart failure due to any cause, chronic liver disease or renal failure.
5. Pre-existing entero-cutaneous fistula, ostomy, skin defect.
6. Patients already suffering from respiratory compromise, i.e. COPD.

METHODS

Patient related factors to be recorded will be age, gender, abdominal surgery history, BMI, COPD, diabetes, smoking status, constipation, prostatism, site & size of abdominal wall defect & the symptom/s urging the current hernia repair. Any evidence of skin defect, fistulation or ostomy etc. will also be recorded. Apart from the routine investigations, CT Scan abdomen, i) to measure the hernia defect; ii) to see all other hernias e.g. ostomy site hernia iii) to know

about condition of abdominal muscles; iv) to measure loss of domain, will be done for every patient along with other investigation like ultrasonography of abdomen, echocardiography, spirometry will be optional according to the requirements of the situation. All efforts will be made to eliminate any local skin infection etc. pre-operatively.

The procedure, will be started by generous midline laparotomy incision and removal of all previously implanted synthetic material (mesh). Complete adhesiolysis, at least of all attachments to the abdominal wall and dense interbowel adhesions, will be performed to create a maximally mobile abdominal wall with no fibrotic restraints. Next step is the creation of the retrorectus space which is initiated at the level of the umbilicus. An incision is made on the posterior sheath 0.5 cm away from its medial edge. Rectus Abdominis is identified to prevent entering the pre-peritoneal plane. The incision is extended cranially and caudally on the entire length of the Rectus sheath and the retro-rectus space is developed by blunt or sharp dissection. Laterally the dissection is extended to the semilunar line. Care is taken to prevent damages of the epigastric vessels and of the neurovascular branches of the Rectus Abdominis muscle which perforate the posterior sheath just medial to Spiegel line. The retro-rectus plane is continued by cranial dissection to the retro-xiphoid plane and caudal in the pre-peritoneal space of Retzius with identification of both Cooper's ligaments and pubic symphisis.

Next is the incision of the posterior rectus sheath in the upper third of the abdomen, 0.5 cm medial to the perforating neurovascular bundles of the thoraco – abdominal nerves the posterior rectus fascia is sharply incised to expose the underlying Transversus Abdominis muscle.

Once the muscle is exposed the fibers are then divided along its entire medial edge. The separation from the pre- peritoneal plane is easily with an "L" curved dissector. (In the upper third the muscle is well developed and easy to identify; its volume regress in the distal 2 thirds where there is no muscle but only tendinous component.)

Creation of the fascia transversalis plane between the edges of the transected Transversus Abdominis muscle a new pre-peritoneal plane is created. Two Allis clamps on the lateral edge of the Transversus Abdominis muscle are elevated together with the muscle by the assistant surgeon. Left hand of the surgeon pushes inferiorly the medial edge of the Transversus Abdominis muscle so a dihedral angle is created between the muscle and the peritoneum. With a mounted swab the undersurface of the lateral border of the Transversus Abdominis muscle is freed from the fascia transversalis and peritoneum. All peritoneal tears must be carefully closed with an absorbable suture (3-0 Vicryl) to avoid protrusions of the small bowel under the mesh. Laterally the dissection is extended as far as the psoas muscle; its lateral border is used as a landmark.

The cranial extend of the dissection depends on the extend of the defect; in upper hernias the space is advanced cranially through the costal margins to view the diaphragm. Inferiorly the pre-peritoneal plane is contiguous with the space of Retzius in the median line and with the space of Bogros on its lateral part. Trans-section of the medial attachments of the arcuate line of Douglas to the linea alba allow the access to the pre-peritoneal plane. Parietalization of the cord or resection of the round ligament extend the dissection in the space of Bogros and both myopectineal triangles.

The posterior sheath is now reapproximated on midline with running, 2-0 delayed absorbable suture (PDS) recreating the visceral sac.

This is followed by mesh placement, which is placed in sublay position in a diamond configuration, occupying all the retromuscular, preperitoneal, and retroperitoneal spaces. The inferior aspect of the mesh is secured to both of Cooper's ligaments and the pubis with interrupted sutures of no. 1 slowly absorbable material. Superiorly, the mesh is secured with 2 interrupted sutures around the xiphoid and on each costal margin. The lateral aspects are left free. Then two large suctions drains are placed over the mesh and anterior fascial closure is done using Prolene 1-0. It is followed by approximation of skin and subcutaneous tissue.

Post-operatively strict bed rest is advised for 3 days. Pulmonary physiotherapy is started. Drains will be allowed to stay in situ until the 5^{th} post-operative day or till the drain output drops to <30ml per day. Additionally, when patients are mobilized an abdominal binder will be applied to further diminish the risk for seroma formation. Oral sips of water are started on post operative day 1 and semi solid diet introduced when patient passes flatus followed by full diet after passage of stool. Patients will be discharged after they start accepting full diet orally and there is no problem in passage of flatus and stool.

DURATION OF STUDY

The study will be conducted on patients with "Large ventral Hernia", admitted to "Dayanand Medical College and Hospital, Ludhiana" during the period "November 1, 2018 to April 30, 2020".

OUTCOME

The clinical outcome in patients will be measured in terms of:

a) operation time;

b) hematoma;

d) seroma;

e) infection;

f) length of hospital stay;

h) occurrence of pain abdomen post operative (by visual analogue scale);

i) Any other complication

h) Recurrence of hernia (by Ultrasound of the abdomen)

The patients will be followed up during the hospital stay as well as for a period of three months after discharge from the hospital.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Patients presenting included in the study will have to undergo haematological, biochemical or radiological investigations as per the protocol. For this patients included in the study will be informed regarding their inclusion and written informed consent will be taken for all the patients included in the study. These

are however, essential for the patient management and are a part of the routine protocol for the management for ventral hernias.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attatched alongwith.

8. LIST OF REFERENCES

1. Mudge M, Hughes LE. Incisional hernia: a 10 year prospective study of incidence and attitudes. Br J Surg. 1985;72(1):70-1.
2. Lewis RT, Wiegand FM. Natural history of vertical abdominal parietal closure: Prolene versus Dexon. Can J Surg. 1989;32(3):196-200.
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PROFORMA

Sr no.

1. NAME: **2. Age:** **3.M / F**

4.C R No: **5. Admission No:** **6.DoA:**

7.DoD: **8.Occupation**

9.Address

10a.History-Present

Swelling- Size

Reducibility

Pain Abdomen (on a scale of 1-10)

Distension

Constipation

Vomiting

Chronic back pain (on a scale of 1-10)

Discomfort in daily life (on a scale of 1-10)

10b. History- Past

Date of laprotomy & reason	Prostatism
Diabetes	Malignancy
Cough/COPD	Chemo/Radio therapy
Hx s/o Connective tissue disorder	Other medications

11. General Physical Examination:

Pulse	Resp	BP	Temp

i)Ht	ii)Wt	iii)BMI	iv)Waist circumference

Signature of Candidate **Signature of Supervisor**

12. Systemic examination:

Chest

CVS

CNS

P/A - Site

Distension

Tenderness

Girth

Max width of defect

Approx area of defect

Reducibility

Condition of overlying skin

Bowel sounds

13. Investigations:-

Hb: TLC: DLC:

Platelet Count:

RFT :- Urea Creatinine

PTI:

INR:

14. Imaging Studies:-

CT scan- Size of defect;

All other hernias-ostomy site;

Condition of abdominal wall musculature;

Loss of domain

Signature of Candidate **Signature of Supervisor**

15. Other investigations:

16. Preoperative antibiotic

17. Surgery

Steps –

Mesh – site and size

Midline approximation

Duration of Sx

18. Post-op

Haematoma

Seroma

Infection

Duration of hospital stay

Pain abdomen (on a scale of 1-10)

19. After D/C from hospital

Status of wound

Recurrence as observed on USG WA at 1 month and 3 months

20. Remarks:-

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

I.....D/o,W/o,S/o.....

am willing to participate in the study **"EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA"**. The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"EVALUATION OF THE TRANSVERSUS ABDOMINIS RELEASE TECHNIQUE FOR REPAIR OF LARGE VENTRAL HERNIA" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ